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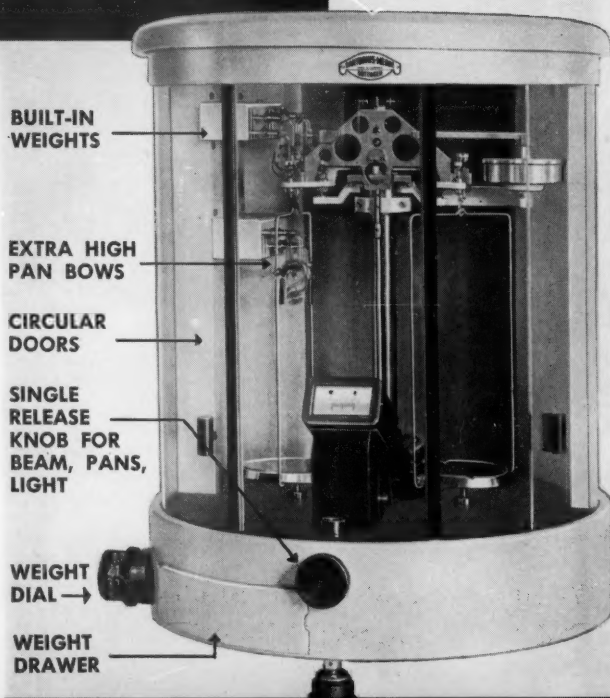
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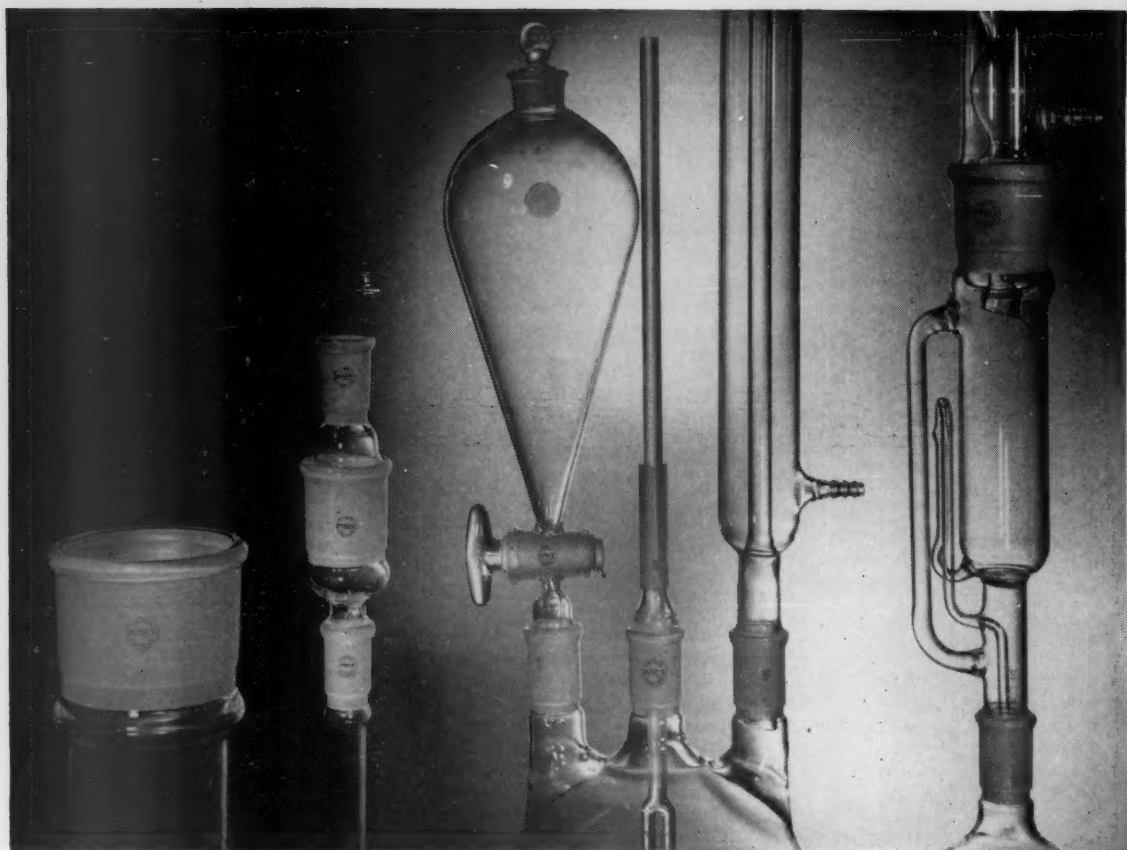
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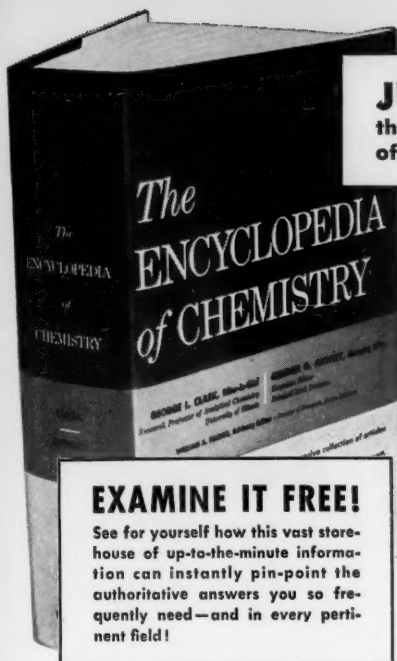
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Triage

Perhaps no one needs to be reminded of the results that would follow a nuclear war, but if anyone does we suggest that he read the article entitled "Sorting—the key to management of victims of disaster," by Lt. Col. H. Haskell Ziperman [*J. Am. Med. Assoc.* **162**, 1438 (15 Dec. 1956)]. Sorting, or triage, has as its aim the classification of the sick and injured according to type and degree of disability in order that they may receive the most appropriate medical care with the least delay. Triage was developed in combat medicine, but, as Ziperman points out, the principles are, with only slight modification, applicable to civilian disaster.

The method consists essentially in establishing a system of priorities for the treatment of mass casualties. Inasmuch as all injured persons cannot be cared for at once, priorities must be established on the basis of the severity of the injury and the urgency for treatment. The casualties must be sorted and sent to medical stations that are prepared to deal with particular types of injury. Or, if supplies are limited and nearly certain to remain so, they should not be rationed equally but should be used according to a systematic principle of evaluation. If, to use one of Ziperman's examples, ten people are suffering from shock and there is only enough blood on hand to treat two, then it is better to treat only two than to waste the blood by treating all ten with an inadequate amount.

But which two? As in military medicine, other principles will have to be taken into account in the event of civilian disasters. It will not be enough to decide whether or not a life can be saved. The sorting officer will be obliged to superimpose another set of values and a correlated set of priorities. When the survival of the whole society is at stake, the sorting officer must decide whether the injured person is likely to return to effective civilian life or whether he will be a burden on the resources available. In short, in a society fighting for survival, a judgment about the value of the injured people to that society would have to be made. The sorting officer would in addition have to decide nonmedical questions of this kind: two people have injuries of equal severity, but only one can be treated. Which one? Surely the reasonable answer would have to be that the one to be saved would be the one who was of the greatest potential value to the survival of the society.

A grim choice! But it is a choice that will have to be made, and made often, should we fail to find a way to avoid nuclear war.—G. DUS.



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Temperature and Age Analysis of Deep-Sea Cores

Cesare Emiliani

Several papers have been published recently dealing with the stratigraphy of foraminiferal lutite in deep-sea cores and its relationship to continental Pleistocene stratigraphy (1-6). The deep-sea record has been studied by different methods. I have used oxygen-isotopic analysis; Ericson and Wollin have used micropaleontological analysis; and Rubin and Suess and Broecker, Kulp, and Tucek have used radiocarbon analysis. The results have been interpreted somewhat differently by Suess (6) and me (1, 2) on one side and by the group at the Lamont Geological Observatory on the other side (3, 5, 7). The purpose of this article is to analyze these differences and to draw the possible conclusions from the published evidence.

Stratigraphy and Micropaleontology

Ericson and Wollin (3) have recently determined the temperature variations in three deep-sea cores from the Caribbean and the equatorial Atlantic Ocean by the following methods: (i) the relative abundances of the pelagic foraminifer *Globorotalia menardii* and other warm-water, pelagic foraminifera in the fossil fauna and (ii) the number of specimens of *Globorotalia menardii* per milligram of the sediment fraction that is larger than 74 microns. The results were compared with the paleotemperatures determined by means of oxygen-isotopic analysis.

The first method fails to reveal clearly cold stages 6, 8, and 10 in core A172-6 and cold stages 8 and 10 in core A179-4 (8). The second method, on the other

hand, yields good correlation with the isotopic temperatures for all stages down to stage 11. *Globorotalia menardii* is rare or absent in stage 12, which was shown to have been cool by isotopic data, and in stage 13, which was shown to have been as warm as any other warm stage. Ericson and Wollin concluded that stages 12 and 13 correspond to one glacial age, and they suggest postdepositional oxygen isotopic exchange between shell material and water as a possible explanation for the isotopic values that have been measured in stages 12 and 13.

Bottom water is colder than superficial water, however, and exchange could have resulted only in the displacement of isotopic temperatures below the actual temperatures. Consequently, if isotopic exchange occurred, the true temperatures of stages 12 and 13 would be even higher than those shown by the isotopic analyses. Paleotemperature analysis of Tertiary cores from the Atlantic Ocean (9) indicates that no appreciable isotopic exchange has occurred in 20 to 30 million years. The presumption that isotopic exchange took place in a few hundred thousand years is not acceptable (10) and the fully interglacial character of stage 13 must be maintained.

This conclusion is supported not only by the isotopic results, but also by the sedimentological, chemical, and micropaleontological data presented by Ericson and Wollin (4).

The weight percentage of the sediment fraction larger than 62 or 74 microns shows good correlation with isotopic temperatures in all cores for which data are available, unless postdepositional solution has interfered (1, 4). This correlation indicates that the average weight of pelagic foraminifera is a direct function of temperature. The value of this parameter for stage 13 of core A179-4 is typi-

cal of warm stages, and this is also true for core A172-6 if levels of postdepositional solution are excluded.

Twelve chemical analyses for various levels of core A179-4 (4) show carbonate values ranging from 48.8 to 77.0 percent in stages which isotopic results show to have been warm, and carbonate values ranging from 43.7 to 50.7 percent in cold stages. Two analyses (at 640 and 690 centimeters below the top of the core) correspond to stage 13, and the results (59.7 and 55.0 percent, respectively) are within the range of values for the warm stages and agree with the isotopic evidence.

Globorotalia menardii seems to offer an often reliable method for estimating temperature variations, especially if Ericson and Wollin's method, which consists of expressing abundance by the number of specimens per milligram of the sediment fraction larger than 74 microns, is used. However, negative results owing to absence of this species or any other warm-water species may not necessarily indicate low temperature. Such species, in fact, may be replaced by other warm-water species of similar depth habitats.

Absolute estimates of the abundance of pelagic Foraminifera in cores A179-4 and A172-6 were published by Ericson and Wollin (4) using six symbols. Their data for various species in the two cores are shown as graphs in Figs. 1 and 2. The estimates of abundance were limited to the level of 100 specimens per tray spreading—that is, variations in abundance were considered only when numbers smaller than 100 were involved. Some species generally are present in greater abundance throughout the cores (*Globigerinoides rubra* and *G. sacculifera*), and their variations were not determined. Graphic representation of the data would be a straight line. Other species occur in greater abundance through long sections of the cores, where they form broad, flat peaks in the graphs (for example, the *Globorotalia menardii* group). The abundances of still other species vary between zero and 100 specimens per tray spreading, and their variations may be compared with the variations of the isotopic temperature. In making such comparisons, one should keep in mind that, as pointed out by the authors, the abundance estimates are very crude, and correlations should be viewed with considerable optimism. More accurate abundance determina-

Until 31 Dec. 1956 Dr. Emiliani was on the staff of the Enrico Fermi Institute for Nuclear Studies at the University of Chicago. He is now associate professor with the Marine Laboratory, University of Miami, Coral Gables, Fla.

Table 1. Correlation between core stages and continental events according to my method (1) and the method of Ericson and Wollin (3).

Core stage	Emiliani	Ericson and Wollin	
		Core A172-6	Core A179-4
1	Present interglacial	Present interglacial	Present interglacial
2	Würm	Last glaciation	Last glaciation
3			
4			
5	Riss-Würm		
6	Riss		
7	Mindel-Riss	Last interglacial	Last interglacial
8			
9			
10	Mindel		
11	Günz-Mindel	Penultimate glacial	Penultimate glacial
12			
13			
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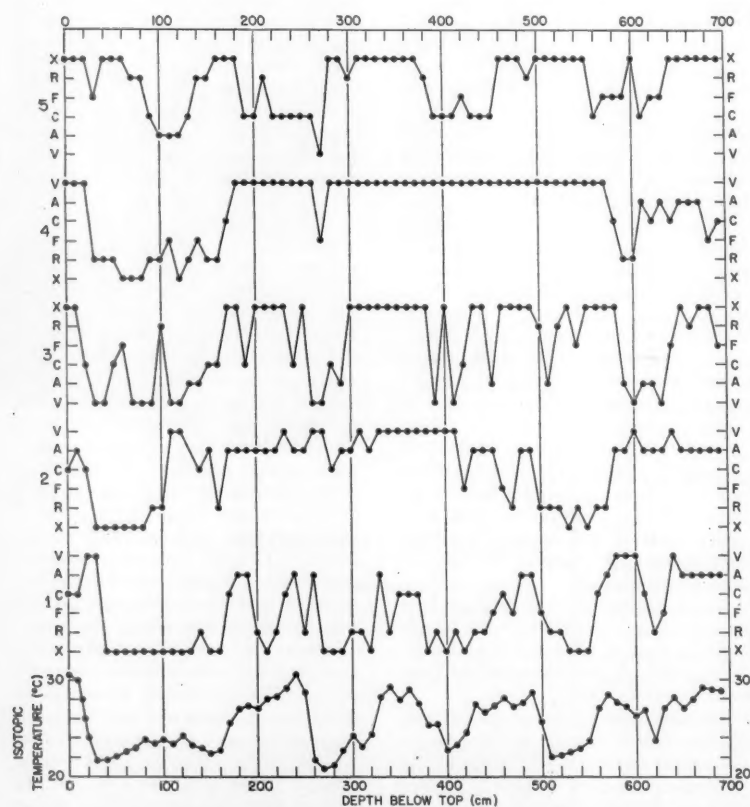


Fig. 1. Isotopic temperatures (from *Globigerinoides rubra*) and foraminiferal abundances of core A179-4: 1, *Sphaeroidina dehiscens*; 2, *Pulleniatina obliquiloculata*; 3, *Globigerina inflata*; 4, *Globorotalia menardii* group; 5, *Globigerina bulloides*. V, very abundant; A, abundant; C, common; F, frequent; R, rare; X, absent (see Ericson and Wollin, 4, p. 116).

tions, in fact, probably would have resulted in better correlations.

The last temperature rise is clearly shown by all species except *Globigerina bulloides* (Fig. 1). This species is too rare in core A172-6 and is not shown in Fig. 2. *Globigerina bulloides* does not seem to correlate with temperature except occasionally. The ordinate for this species and for *Globigerina inflata* has been inverted to facilitate comparison.

The *Globorotalia menardii* group shows a good correlation with temperature for stages 1 to 5 and also for stage 13 in core A179-4 only. No abundance variations are shown by the graphs in the mid-portion of the cores because of the afore-mentioned artificial boundary condition. Actually, the absolute abundance of this species varies considerably over this interval, as may be calculated from the data of Tables 2 and 3 in one of the papers by Ericson and Wollin (3) and from the top graphs of Figs. 2 and 3 in one of my papers (1). The absolute abundances correlate with isotopic temperature in a way similar to that of the number of specimens per milligram of sediment fraction larger than 74 microns.

Globigerina inflata shows a fairly good correlation with temperature, although many irregularities occur. In particular, abundance values characteristic of warm stages may be noticed in stage 13 of core A179-4. The evidence is inconclusive for stages 11 to 13 of core A172-6 because peaks and valleys cross stage boundaries.

Pulleniatina obliquiloculata shows good correlation with isotopic temperatures throughout most of the two cores. Stage 6, however, is very poorly represented, and the evidence for stage 11 is inconclusive. Stage 13, on the other hand, is represented in both cores by abundance values that are typical of warm stages.

Sphaeroidina dehiscens shows in both cores a correlation with isotopic temperatures which is considered excellent. All stages except stage 3 of core A179-4 are well represented. Values typical of warm stages occur at stage 13 in both cores.

In conclusion, the species for which significant variations in abundance can be derived from Ericson and Wollin's tables clearly indicate that stage 13 was warm. The exceptions, which occur only in core A172-6, are *Globorotalia menardii* and, to a smaller degree, *Globigerina inflata*. The interglacial character of stage 13, therefore, seems to be well established also on micropaleontological grounds.

Correlations with Continental Events

Ericson and Wollin (3) correlated temperature variations of the cores with glacial and interglacial events of the con-

tinents in a way entirely different from that suggested by me (Table 1). The foregoing evidence for a warm stage 13, however, seems sufficiently strong to require that the correlation proposed by these authors should be abandoned.

Ericson and Wollin (3, text Fig. 4) correlated stage 3 of core A172-6 with stage 5 of core A179-4 (Table 1), on the basis of the *Globorotalia menardii* abundances alone (Figs. 1 and 2, curves 4). This correlation, however, is contradicted by (i) the abundances of such other species as *Pulleniatina obliquiloculata* and *Globigerina inflata* (Figs. 1 and 2, curves 2 and 3), (ii) the percentages of the sediment fraction larger than 74 microns (1, Figs. 2 and 3, upper curves), and (iii) the isotopic temperatures (1, Figs. 2 and 3, lower curves). Furthermore, not only is the maximum isotopic temperature of stage 3 in core A172-6 much lower than the maximum of stage 5 in core A179-4, but also core A172-6 shows a rate of sedimentation higher than the other core, so that it is difficult to see how stage 3 of core A172-6 (maximum at 170 centimeters below the top)

could correspond to stage 5 of core A179-4 (maximum at 240 centimeters below the top) unless considerable changes in the rates of sedimentation are assumed to have occurred within each core. Rates of sedimentation, however, appear to have remained remarkably constant within each core (1).

Core stage 3, which represents a cool, interglacial stage, is clearly shown by the isotopic temperatures in core A172-6 and in core 189 from the Mediterranean Sea. It is less evident in other cores (A179-4 and 234) and very obscure in some (A180-73 and 246) (1, 2). It is again very clear in core 280 (11).

Ewing and Donn (7), apparently relying more on negative evidence, stated that temperature decreased at the rate of about 1°C per 11,000 years from 90,000 to 11,000 years before the present. However, while the record contained in a natural layered medium can be easily smoothed by natural agents, it cannot be enhanced, so that positive evidence for a parameter gradient should outweigh negative evidence. The conclusion is justified, therefore, that temperature de-

creased from the maximum of stage 5 to the minimum, about as low as any other, of stage 4; it then rose to the minor maximum of stage 3 and decreased to the new minimum of stage 2, after which it finally rose to its modern values (stage 1).

Beginning of the Last Rise in Temperature

Dating the beginning of the last rise in temperature was the object of radiocarbon measurements performed by Rubin and Suess (12, 13) on deep-sea core material at my suggestion. Ericson and Wollin (3, text Fig. 6) and Ericson *et al.* (5) presented several radiocarbon dates determined by Broecker, Kulp, and Tuček (14) for five Atlantic Ocean cores that have not been analyzed isotopically for temperature. The core levels corresponding to the beginning of the last temperature rise were determined micropaleontologically in these five cores. This method seems reliable in view of the excellent correlation between isotopically and micropaleontologically determined

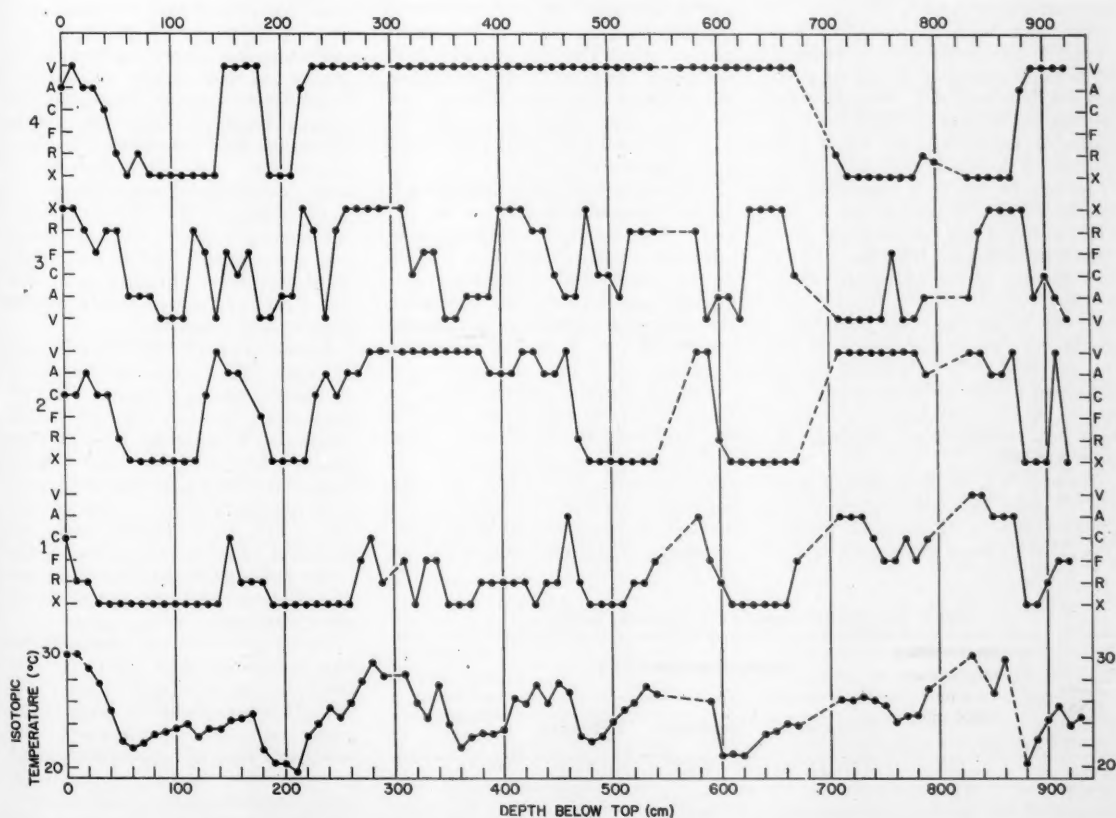


Fig. 2. Isotopic temperatures (from *Globigerinoides rubra*) and foraminiferal abundances of core A172-6: 1, *Sphaeroidina dehiscens*; 2, *Pulleniatina obliquiloculata*; 3, *Globigerina inflata*; 4, *Globorotalia menardii* group. V, very abundant; A, abundant; C, common; F, frequent; R, rare; X, absent (see Ericson and Wollin, 4, p. 116).

Table 2. Levels and radiocarbon ages of the beginning of the last temperature rise in deep-sea cores.

Core No.	Location	Depth below top of core (cm)	Radiocarbon age (yr)	Laboratory
A172-6	Caribbean	50	15,900	Washington
A179-4	Caribbean	30	13,600	Washington
A180-73	Equatorial Atlantic	30	13,600	Washington
A180-74	Equatorial Atlantic	35	13,600	Lamont
A180-48	Subtropical Atlantic	530	16,000	Lamont
189	Mediterranean	10	16,000	Washington
R10-10	North Atlantic	115	11,000	Lamont
A179-8	Subtropical Atlantic	270	13,200	Lamont
A179-15	Subtropical Atlantic	115	11,000	Lamont

temperatures in the upper portions of cores A172-6, A179-4, and A180-73 (4, Fig. 10).

Table 2 is a complete list of cores in which the beginning of the last temperature rise has been dated by the radiocarbon method. The Lamont dates and the Washington date for core 189 present some uncertainties because the analyses were performed on bulk core material, a method that may yield ages at some variance with those obtained from pure foraminiferal shells (5, 6, 13).

The depths below the tops of the cores (Table 2) refer to the levels corresponding to the beginning of the last temperature rise. The level of 30 centimeters below the top for core A180-74 has been chosen on the basis of the weight percentages of the size fraction larger than 74 microns (4, Fig. 6), a parameter that correlates well with temperature (1, 4). The corresponding radiocarbon ages have been calculated from the rates of sedimentation in the immediate neighborhood (cores A180-74, R10-10, and A179-15), in the whole core (core 189), and in the whole upper portion of the core on the basis of an assumed age of 2000 years (Table 3) for the top (cores A172-6, A179-4, and A180-73), or they have been estimated by extrapolation (core A180-48).

Cores A172-6, A179-4, A180-73, and A180-74 show particle-by-particle accumulation and an undisturbed record. Core A180-48 seems undisturbed in the

section where the beginning of the last temperature rise may be placed. The top of core 189 is missing (2), but the level corresponding to the beginning of the last temperature rise is apparently preserved.

The rapid sedimentation of core R10-10 (average 12.6 centimeters per 1000 years) should have reduced the amount of reworking by bottom organisms. On the other hand, the mechanism of accumulation (about 50 percent by submarine solifluction, 15) suggests that mixing may have been greater than that resulting from the action of bottom organisms alone. That this may have been the case is indicated by the remarkable age of the top of the core (Table 3) and by the fact that different levels (3.5 and 37.0 centimeters; 95.0 and 116.0 centimeters) gave identical ages (14). Cores A179-8 and A179-15 offer abundant evidence of submarine solifluction and turbidity currents (3, 5). Sedimentation rates vary greatly within cores R10-10, A179-8, and A179-15, while they are remarkably uniform within the other cores. It is apparent from this that the radiocarbon ages obtained from these three cores should be viewed with caution.

Table 2 shows a discrepancy up to about 2000 years among the radiocarbon ages from the undisturbed cores. Sample spacing of the isotopic, micro-paleontological, and sediment size fraction analyses (usually 10 centimeters) introduces an uncertainty in determining the exact level corresponding to the be-

ginning of the last temperature rise. The levels of Table 2 have been chosen, within the permitted limits, to minimize this discrepancy. Consequently, the discrepancy is at least as large as that shown. In particular, cores A179-4, A180-73, and A180-74 indicate that the last temperature rise began not earlier than about 13,500 years ago, while cores A172-6, A180-48, and 189 indicate that it began not later than about 15,500 years ago. This discrepancy may be due to different reworking by bottom animals in different cores, a factor that is probably inherent to aerobic deep-sea sediments.

It is difficult to draw satisfactory conclusions from the data of Table 2. One may choose as the most probable date the average of the undisturbed cores (14,800 years), or one may prefer the age given by Core A172-6 (15,900 years) on the grounds that its faster and yet undisturbed sedimentation permitted better identification of the exact level corresponding to the beginning of the last temperature rise. In either case, an age of about 15,000 years is suggested.

Some evidence that this may be about the right age is that 11,000 years ago sea level had already risen to within about 30 meters of the present surface (14, 16), indicating that about 70 percent of the glacial ice had already melted. Two wood samples from the sand-to-silt transition at depths of 30 to 45 meters in the Mississippi delta were dated at 10,000 to 11,000 years (14). This was taken to date an important climatic change (5), but it is possible that this date refers to the opening of the St. Lawrence waterway by retreating ice, which reduced the Mississippi River discharge by at least one third and correspondingly reduced capacity and competency.

Ericson *et al.* (5) stated that the age of 11,000 years refers to the midpoint of the rising temperature curve and that the temperature rise took place in 1000 to 2000 years. While an age of 11,000 years for the midpoint of the rising temperature curve probably is about correct and is in agreement with my previous conclusion (1), all undisturbed long cores as well as all pilot cores (1, Figs. 8-10) clearly indicate that the temperature rose gradually and that the process lasted about 8000 years.

Four radiocarbon age measurements have been published for levels a few centimeters below the tops of the cores (12-14). These are shown in Table 3 together with the ages calculated from postglacial rates of sedimentation based on radiocarbon dates from older levels. An average discrepancy of 2000 years occurs between these two sets of data. This might result from failure to recover the top portion of the sediment during coring operations. Comparison, however, of the

Table 3. Radiocarbon ages of core levels near the tops.

Core No.	Depth below top of core (cm)	Radiocarbon ages (yr)			Corresponding sediment thickness (cm)
		Calculated	Measured	Difference	
A172-6	5.0	1,400	3,700	2,300	8.0
A179-4	5.0	2,300	3,950	1,650	7.5
A180-73	4.0	1,700	2,960	1,260	3.0
A180-74	2.5	1,500	3,630	2,130	3.6
R10-10	3.5	440	4,160	3,720	30.0
Average (excluding core R10-10)				1,835	

isotopic temperature graphs of core A179-4 and its pilot core A179-TW4 (1, Figs. 2 and 7) shows clearly that nothing was lost from the top of core A179-4. It is not unreasonable to assume that the cores of Table 3, which were all raised with Ewing's piston corer (compare 4), are also complete. If so, the discrepancy may be explained by assuming that burrowing organisms mixed the top few centimeters of the sediment. Complete homogenization could occur only within thicknesses of a centimeter or so, and mixing would be smaller for greater thicknesses. Very little mixing, if any, is believed to have occurred between levels 10 centimeters apart. Failure of the isotopic data of pilot cores (1, Figs. 7-10) clearly to reveal temperature variations corresponding to the Wisconsin substages may be an indication of such mixing.

If mixing is occurring at the present sedimentary surface, the same process may be assumed to have disturbed sediments deposited at earlier times. If the radiocarbon age of the modern, superficial sediment is 2000 years, it might be

necessary to reduce all radiocarbon dates so far obtained from deep-sea cores by that amount. Consequently, the previous estimate of 15,000 years for the beginning of the last temperature rise would be reduced to 13,000 years.

It is apparent, from this discussion, that dating of the last temperature rise of the superficial waters of the oceans is unsatisfactory at present. Further research of greater detail is needed. In particular, closely spaced samples from deep-sea cores, covering the last 20,000 years, should be analyzed isotopically, and radiocarbon measurements should be performed on foraminiferal shells from critical core levels.

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Recruitment of Women in the Engineering Profession

William M. Evan

The widespread use of the term *manpower* in connection with problems of labor shortages and the utilization of human resources suggests a pervasive cultural bias, for what about "womanpower" in the labor force? To contend that this is merely a manner of speaking overlooks the fact that language is related to cultural and social phenomena. This bias may result in ignoring or underestimating one major source of supply in the current efforts to solve the shortage of engineers.

The underrepresentation of women in engineering is marked indeed. In 1955, 0.2 percent (or 62) of 22,589 engineering graduates were women (1). And the proportion of women in the engineering profession as a whole, as of 1950, was 1.24 percent (2, p. 230, Table VIII. 1). This is a notably smaller proportion than is found in any of the other professions which are not predominantly female. (In the "predominantly female" category

are nursing, social work, library work, and school teaching.) In 1950, the proportion of women in medicine was 6.1 percent; in law, 3.5; in the ministry, 4.1; in college teaching, 23.2; and in journalism, 32.0 (2). Thus, both in absolute and in relative terms, the role of women in engineering is negligible.

What are the obstacles to recruitment of women in engineering? What factors, if any, favor recruitment? What are the policy implications of the analysis of this problem?

Obstacles to Recruitment

Of all factors that may account for the negligible number of women engineers, those pertaining to biology—allegedly, IQ and temperament—are least relevant. Psychologists have found that intelligence is normally distributed and is not related to sex. Likewise, tempera-

ment, about which little scientific knowledge exists, would not account for the low rate of recruitment of women in engineering. Whatever the temperament of engineers, assuming that it is distinctive, it has not been established that it is a common—much less exclusive—attribute of males.

Psychological factors in terms of personality development are relevant. Again, such factors may vary independently of sex, though the possibility is by no means excluded that engineers tend to have, or tend to develop, characteristic modes of thinking and feeling, and characteristic interpersonal relations, which are less commonly found among American women.

Such an old psychological dichotomy as "tough-mindedness" versus "tender-mindedness" may be related to sex. Assuming that engineers are generally "tough-minded" because of the occupational demands for "rational" and "factual" analysis, women, who may be predominantly "tender-minded" and given to "intuitive" and "emotional" patterns of behavior, would not be attracted to the profession. These psychological differences may exist, though they have been inadequately studied insofar as occupational recruitment in general is concerned and engineering recruitment in particular.

Of central importance are the sociological aspects of the problem, namely, the cultural and social factors impeding

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recruitment of women in the major professions, including engineering. Culturally, the American woman, particularly in the middle class, is expected to assume and to value the housewife's role in the family. Since, in general, she derives her social status from her husband, any serious occupational involvement, such as a professional career would entail, might mean competing with her husband. If she should excel him in occupational achievement, this would upset the prescribed identity of social status within the family, to the possible detriment of the husband's career and contradict the culturally approved roles for the married couple.

This cultural definition of the female role in the family tends to channel the interests of college women into general liberal arts and home economics curricula, on the one hand, and into female professions, on the other.

It is quite possible that, of all the major professions, engineering enjoys the most masculine public image. This may be due, in part, to the fact that the public image of the engineering profession prevalent today is still that of engineering of a generation ago, when its kinship with skilled trades was closer than it is now. Early civil, mechanical, and mining engineers may have had to engage in a modicum of muscular and manual activity, or so the public thought upon contemplating such end-products as bridges and tunnels. Given this highly masculine public image, the college woman would have to be exceptionally highly motivated to major in engineering. This might be interpreted as detracting from her femininity and reducing her matrimonial chances.

Social factors also operate to discourage women from pursuing professional careers, including engineering. From infancy onward, influences and pressures are brought to bear on the girl to learn and value the culturally approved adult female role of the housewife. Parents insist on appropriate feminine toys for their daughter, preferring dolls to chemistry sets; playmates enforce a pattern of speech and action which is deemed lady-like; teachers tend to relax intellectual standards for girls; and mass media of communication extoll the glamorous girl, the loving mother, the efficient homemaker.

These sex-differentiated cultural expectations and social relationships extend to the college campus as well as the labor market. Some administrators of engineering and other professional schools are prejudiced against admitting women, doubting their intellectual ability or the propriety of women's performing such occupational roles (3, p. 237). Likewise, some employers discriminate against women professionals, including engineers,

in their employment practices (2, pp. 232-233; 3, p. 240; 4, p. 9), either because of the high turnover of women in industry resulting from marriage and pregnancy or because of the opposition of male employees who feel that the presence of women is a threat to the cohesiveness of the work group (3, pp. 241-242).

That these cultural and social factors serve to restrict the recruitment of women in engineering, and in other principal professions, becomes even more evident when we compare the role of women in the professions in the United States with that in the U.S.S.R. Because of internal and external pressures for rapid industrialization, since the Russian Revolution, and because of the Communist ideological emphasis on social equality of the sexes and on extensive educational opportunities, Soviet women occupy a prominent role in the professions in general, and in engineering in particular. In sharp contrast to the situation in the United States, the proportion of women in all professions in the Soviet Union in 1954 was about 50 percent (5).

Factors Favoring Recruitment

Offsetting, in part, these obstacles to recruitment of women in engineering and other professions are long-term trends in industry, in the family, and in education.

Technologic advances that have resulted in rising productivity levels have led to a shift in the labor force from agricultural and manufacturing industries to service industries, such as communication, education, health, and entertainment (6). Service industries (and these include professional services) afford more suitable employment for women, in terms of working conditions, than do agriculture and manufacturing. Technologic advances combined with expansion of service industries have, in turn, reduced the "man-hours" the housewife is required to expend in management of the home. Furthermore, the decline in the number of working hours—a corollary of some of these industrial changes—facilitates performance both of the role of housewife and of that of career woman. Attesting to this fact is the rising proportion of women in the labor force, which reached 28.5 percent in 1950 (7).

Supporting this dual role for the woman are two trends in the family institution. First, with earlier marriages, child-rearing is completed earlier, and this frees the woman sooner for a possible career. Second, as the patriarchal authoritarian family is increasingly replaced by the companionate equalitarian family (8), the married career-woman is finding greater cultural acceptance. An

emerging value in this new type of family is that both spouses—especially the wife—have the opportunity to realize their talents and capacities.

Interrelated with these trends are ongoing changes in the sphere of education. College education has not only become more available than it was in the past, at both public and private colleges and universities, but also more valued. With increasing college enrollment, the proportion of women students has risen. And the occupational behavior of women college graduates has been, and will probably continue to be, distinctive. Regardless of age and marital status, women college graduates are more likely to be in the labor force than are noncollege women (2, pp. 226-228). Furthermore, not only do women with college degrees comprise an increasingly large proportion of the labor force but their proportion in all the major professions has been increasing in the past few decades (2, pp. 229-230).

Together, these trends in industry, in the family, and in education are creating more favorable conditions for the recruitment of women in all professions, including engineering.

Policy Implications

Given these trends, a program of action—following a policy decision on the desirability of recruiting women engineers—aimed specifically at overcoming some of the obstacles to the entry of women in engineering may prove effective (9). The audience for such a program would vary, depending on the particular objective in view. The public at large, and especially parents, would have to be informed about the work of engineers—that "most professional engineering jobs are accomplished at a desk" and "require no more physical exertion than wielding the compass and slide rule" (4, p. 7)—to counteract the highly masculine public image of the engineering profession. Grade-school and high-school teachers must be convinced that girls are intellectually capable of pursuing interests in science and technology. College administrators must be persuaded of the wisdom and propriety of admitting women students to engineering schools. Female high-school students should be informed of the diversity of talents called upon in the various branches of engineering and of the contribution they can make to the development of technology. And finally, employers should be prevailed upon to liberalize their employment policies regarding women engineers. In the conduct of such a program of action, professional engineering societies can exert their influence and prestige to increase the likelihood of its effectiveness.

Although usually the rates of cultural and social change are slow, planned action, particularly if it is in harmony with ongoing changes, may serve to accelerate them. Although no single measure is likely to restore the balance between labor supply and demand in the engineering profession, utilization of the potential source of womanpower offers one of the most effective solutions to a problem which is likely to persist for many years to come.

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News of Science

Device for Measuring Radiation

A new and relatively inexpensive device for world-wide comparisons of x-ray measurements, intended eventually to contribute to uniform standards and to help control the medical irradiation of populations, will soon be made generally available through the cooperation of the United Nations Educational, Scientific and Cultural Organization, the World Health Organization, and the U.S. National Bureau of Standards.

The radiation measurement project received the endorsement of the United Nations Scientific Committee on the Effects of Atomic Radiation at its session in New York in October 1956. The committee found that diagnostic radiology and radiotherapy now constitute in some countries the principal source of artificial radiation, in amounts approximately equal to natural radiation. The fact that many countries have no primary standards of x-ray measurement was recognized as a serious problem after studies of radiation demonstrated that populations may be subjected to more radiation from medical radiology than from fallout or effects of nuclear waste disposals.

Not only do many countries have no primary standards, but they have had no opportunity to check the standards they use against the primary standards in use in scientifically more advanced countries. To meet this problem, the National Bureau of Standards in Washington, D.C., has developed an ionization chamber and accessory equipment that UNESCO and WHO will circulate to

countries that request it. Specialists in the operation of the instruments will also be provided. The National Bureau of Standards plans to have the equipment available for circulation very shortly.

UNESCO's participation in the program was approved by the organization's General Conference at its recent meeting in New Delhi, and UNESCO plans to finance the use of the equipment in countries requesting it under the general program of aid to member states. The cost of the equipment itself is small—on the order of \$2500—and UNESCO now plans to purchase a second set from the National Bureau of Standards. In that case, one set probably could be sent to Asia for circulation among nations of that area.

Public Health Training

The Public Health Service has announced that it is ready to accept applications from public health workers for graduate or specialized training for the 1957-58 academic year under the special training legislation voted by Congress last July.

In the President's budget, submitted 16 Jan., \$2 million is requested for the program in fiscal year 1958 to give additional training to physicians, sanitary engineers, nurses and other professional people who are now working in public health or who are interested in entering this field. Congress voted \$1 million for the first year of operation of the program, and more than 300 traineeships

have been awarded, either directly by the Public Health Service or through grants to the training institutions. This includes 16 physicians, 150 nurses, 33 health educators, 25 sanitary engineers, 26 sanitarians, 11 laboratory workers, 10 dentists, and 9 veterinarians.

The traineeships provide, in addition to academic costs and fees, stipends covering living expenses for the trainee and legal dependents. Applicants are urged to submit their applications by 1 Apr., if possible. Information regarding the program is being made available by the service's Bureau of State Services, Division of General Health Services.

Maya Excavation

Gordon F. Ekholm, associate curator of archeology at the American Museum of Natural History, has left for Tabasco, Mexico, where he will lead the second phase of an archeological study of the ancient Maya that is being sponsored by the museum. He plans to continue work begun last spring at Comalcalco in southeastern Mexico. This city, an important center of the pre-Columbian world, thrived from about A.D. 500 to 900. There are some partially preserved buildings still standing at the site but most of the constructions that once existed have been reduced to mounds of earth.

The work at Comalcalco is part of a long-range project to learn more about western Tabasco and the whole Isthmus of Tehuantepec region, an area of potentially great importance to Middle American archeology. The site at Comalcalco is the most westerly of the big Maya cities dotting southeast Mexico and Guatemala and, therefore, represents the farthest penetration of Mayan civilization in that direction. It also enjoys the distinction of being the only archeological site in the New World built entirely of fired brick.

During the first phase of the investigations, carried on last spring, two important buildings were excavated: a palace and a temple. In addition 1700 pounds of pottery, fragments of stucco sculpture,

and incised bricks were taken back to the museum. This material has shown a good deal about the 400 years of Comcalco's history and has provided information about changing styles in architecture and pottery.

Poland Resumes WHO Participation

The Government of the People's Republic of Poland resumed active membership in the World Health Organization on 1 Jan. Poland discontinued active participation in August 1950. Albania and Bulgaria have also recently resumed active participation in the work of the organization.

Member states that still remain inactive are Czechoslovakia, Hungary, Rumania, U.S.S.R., Ukrainian S.S.R., and Byelorussian S.S.R. In order to facilitate the return of inactive members, the World Health Assembly last year passed a resolution providing that contributions should be paid in full for the years during which countries participated actively in the work of the organization, and that for the inactive years a token payment of 5 percent of the amounts assessed should be required.

Cryotron

Dudley A. Buck, a graduate student and instructor in the Electrical Engineering Department at Massachusetts Institute of Technology, will receive the 1947 Browder J. Thompson memorial prize of the Institute of Radio Engineers for his development of the cryotron, a tiny device to replace transistors and tubes.

The cryotron is perhaps the first practical use of superconductivity—the ability of some metals to conduct current with no resistance at temperatures near absolute zero. In its simplest form, the cryotron consists of a straight piece of wire, around which another fine wire has been wound. A current in the straight wire can be controlled by a current in the winding, because the superconductivity of the straight wire is destroyed by the magnetic field associated with the current in the winding.

The first data-processing equipment in which the cryotron will be used is now being built at Arthur D. Little, Inc., with the cooperation of M.I.T. engineers. The instrument will use 215,000 cryotrons. A conventional computer to do the same job might require more than 50,000 vacuum tubes. Buck has pointed out that present experimental circuits suggest "that a large-scale digital computer can be made to occupy one cubic foot." This estimate, of course, does not include refrigeration and terminal equipment.

Cryotrons will be kept at the necessary low temperatures by liquid helium, the boiling point of which is 4.2°F above absolute zero.

The simplicity of cryotrons makes possible their rapid manufacture by automatic factories. In operation, the consumption of electric power by cryotrons is very low. Though a cryotron can switch from one condition to another as rapidly as a transistor or vacuum tube, one disadvantage at present is the relatively slow speed with which the cryotron circuits switch electric currents among their many paths. Cryotrons today use wires of two rare metals, tantalum and niobium.

Research in Sex Problems

The Division of Medical Sciences of the National Academy of Sciences—National Research Council is accepting applications for grants-in-aid of research for consideration by the Committee for Research in Problems of Sex. This committee is concerned primarily with encouraging research on the mechanisms that control sexual behavior in animals and man. Proposals involving endocrinological, neurological, psychological, anthropological, phylogenetic, and genetic studies directed toward this objective are therefore invited. Requests will also be considered that deal with the physiology of reproduction or with related biological and biochemical fields.

Preliminary inquiries should be addressed to Room 309, Division of Medical Sciences, National Academy of Sciences—National Research Council, 2101 Constitution Ave., NW, Washington 25, D.C. Completed applications for 1957–58 should be postmarked *on or before 1 Apr.*

Gravity Awards

The Gravity Research Foundation has announced its 1957 program of awards for essays on gravity. Five awards will be made on 1 June for the best 1500-word essays on the possibilities of discovering: (i) some partial insulator, reflector, or absorber of gravity; (ii) some alloy or other substance, the atoms of which can be agitated or rearranged by gravity to throw off heat; or (iii) some other reasonable method of harnessing, controlling, or neutralizing gravity. The awards will be, in order, \$1000, \$300, \$200, \$150, and \$100.

Essays must be received at the Gravity Research Foundation, New Boston, N.H., *before 15 Apr.* They will be accepted from anyone who is seriously interested in the application of gravity to practical uses for the benefit of humanity.

All essays must be typewritten in English on paper 11 by 8.5 inches, with two carbon copies. A title covering the area of thought expressed in the essay and a summary paragraph of 100 words or less should be submitted with the manuscript on a separate sheet. A short biographical sketch should also be enclosed.

World Health Day

The United States is joining with other nations in the observance of World Health Day on 7 Apr. Federal agencies this year will observe the theme "Food and health" in programs dealing with nutrition, food production and distribution, and food protection and sanitation. The theme will also be used to recruit young Americans for careers in nutritional and other food and health programs. Agencies participating include the Department of Health, Education, and Welfare, the Department of Agriculture, and the Department of State.

In cooperation with the National Citizens Committee for the World Health Organization, the government committee for World Health Day will also meet requests for material from industries and voluntary groups that plan to observe the day. Special kits of material will be prepared for this purpose. H. van Zile Hyde, chief of the Public Health Service's Division of International Health, is chairman of the interagency committee.

Cancer Society Fellowships

The American Cancer Society has announced that a limited number of fellowships in radiation therapy are offered in 1958–59 to graduates in medicine who have already received thorough basic training in the principles and practice of radiation therapy and who desire to spend additional periods of training in that specialty at certain clinics in the United Kingdom, the Scandinavian countries, and France. Fellowships may begin at any time mutually agreeable to the institution and the fellow. The deadline for receipt of applications is *15 Apr.*

The Cancer Society has also announced that its program of clinical fellowships will continue through the institutional year 1958–59, with fellowships commencing 1 July 1958. These awards are offered to institutions whose postgraduate training programs are approved by the Council on Medical Education and Hospitals of the American Medical Association. The grants offer graduates in medicine opportunities for postgraduate training, emphasizing diagnosis and treatment of cancer.

Applications from institutions must be

submitted by deans, executive officers, or department heads *before 15 Apr.* Note change in deadline from previous years.

Further information about both programs may be obtained from the Director of Professional Education, American Cancer Society, Inc., 521 W. 57 St., New York 19, N.Y.

Harvard-Guggenheim Aviation Center

The Harvard-Guggenheim Center for Aviation Health and Safety has been established at Harvard University's School of Public Health in Boston, Mass. The center, made possible by a grant of \$250,000 from the Daniel and Florence Guggenheim Foundation that is to be allocated over a 5-year period, will begin operation with the start of the 1957-58 academic year under Ross A. McFarland, associate professor in the department of industrial hygiene. Two Daniel and Florence Guggenheim fellowships of \$5000 each will be awarded annually for graduate study at the center. Applications for these fellowships are now being received and considered.

The Harvard-Guggenheim Center will have three basic purposes: to unify basic research into the sharply increasing human problems to the jet era; to give advanced training to physicians, biological scientists, and aeronautical engineers; and to serve as a clearinghouse for technical information on aviation health and safety. It will apply the interdisciplinary or team approach, coordinating the work of such diverse specialists as engineers, physicians, psychologists, physiologists, and anthropologists in solving problems of health and safety in flight.

Nuclear-Powered Merchant Ships

The Atomic Energy Commission and the Maritime Administration have announced a joint long-range program aimed at developing reactor systems for commercially competitive power for merchant ships. This program is in addition to the work now in progress on the first nuclear-powered merchant ship, announced by the President last October.

Museum Butterfly Book

American institutions and publishers of scientific books have fallen far behind the rest of the world in the publication of high-quality color illustrations. This deficiency has prompted the American Museum of Natural History to sponsor publication of *Butterflies of the American Tropics, the Genus Anaea*, by William Phillips Comstock.

The tremendous cost of reproducing the 30 color plates that are planned makes it necessary that the museum, a nonprofit institution, obtain in advance an indication of the demand for such a book. The museum does not expect to recover the full cost of publication. If the response is sufficient to show that a reasonable amount of the expense will be subscribed, the book will be published; should the response be insufficient, the museum reserves the right to return all money received through advance appeal.

All those who wish this book and who wish at the same time to aid the museum in this advancement in scientific publication, are urged to send in orders soon. The prepublication price of the book is \$20 (after publication, \$25). For further information, write to the American Museum of Natural History, Central Park West at 79 St., New York 24, N.Y.

Fermi Professorship

Plans to endow an Enrico Fermi distinguished service professorship at the University of Chicago in memory of the renowned nuclear physicist have been announced by M. J. Kelly, president of Bell Telephone Laboratories, who is chairman of a national committee to establish the professorship.

The new chair, which will be in the university's Institute of Nuclear Studies, is designed to perpetuate and memorialize Fermi's scientific contributions. He was both teaching and conducting research at the institute at the time of his death in 1954.

Serving with Kelly are Walker L. Cisl, president of Detroit Edison Company; Crawford H. Greenewalt, president of E. I. du Pont de Nemours and Company; and Lewis Strauss, chairman of the U.S. Atomic Energy Commission. Questions should be addressed to W. V. Morganstern of the University of Chicago, or W. Fuller, Bell Telephone Laboratories, 463 West St., New York, N.Y.

Behavioral Science Research

The Air Force Office of Scientific Research, Behavioral Sciences Division, has contracted with the University of New Mexico for the establishment of a behavioral science research program. This program is visualized as both immediate and long-range in its objectives. The immediate objective is to bring together for preliminary conference, people of demonstrated interdisciplinary research ability for the purpose of considering research problems and designs in behavioral science problem areas of special importance to the Air Force.

Selected participants will be invited

to assemble at the University of New Mexico for an 8-week period from 17 June to 10 Aug. 1957. As a result of this conference, it is hoped that continuous and extensions of the more promising exploratory work will be pursued.

Student Engineers

A program to help alleviate the shortage of trained engineers has been inaugurated by Fairchild Engine Division of Deer Park, Long Island, in cooperation with the University of Cincinnati; University of Detroit; Antioch College, Yellow Springs, Ohio; Georgia Institute of Technology, Atlanta, Ga.; Drexel Institute of Technology, Philadelphia, and Northeastern University in Boston.

The objective is to combine, in 5 years, 4 years of college education and 2 years of actual experience in aircraft power plant design and development. The plan calls for alternating periods of employment at the engine division plant as a regular employee in any one of the engineering groups, with classroom work at one of the participating engineering schools. The student must be employed in a field related to his academic courses.

Beckman Berkeley Division Expands

A \$1-million expansion program that will triple production capacity and increase plant personnel by nearly 1000 has been announced by the Berkeley Division of Beckman Instruments, Inc. Ground-breaking for the first unit of the project is scheduled within 2 months on a recently acquired 6-acre site adjacent to Berkeley's present factory in Richmond, Calif.

Zoological Nomenclature

The International Commission on Zoological Nomenclature gives notice that beginning 25 July it will start voting on the following cases involving the possible use of its plenary powers for the purposes specified. Full details were published on 25 Jan. 1957 in the *Bulletin of Zoological Nomenclature* (Vol. 13, Pt. 1): (i) *bullata* Müller (O.F.), 1776 (*Akera*), validation (Cl. Gastropoda); (ii) *bengalensis* Daudin, [1802] *Tupinambis* and *salvator* Laurenti, 1768 (*Stellio*), validation (Cl. Reptilia); (iii) *Bithys* and *Chrysophanus* Hübner, 1818 (Neotropical Theclids), suppression (Cl. Insecta, Order Lepidoptera); (iv) *Cephalomutilla* André, (1908), designation of type species (Cl. Insecta, Order Hymenoptera); (v) *Aurelia* Lamarck, 1816, validation (Cl. Scyphozoa); (vi) *Indiana* Matthew, 1902, designation of type

species (Cl. Crustacea, Order Ostracoda).

Comments should be sent as soon as possible, and in duplicate, to the secretary of the commission, Francis Hemming, 28 Park Village East, Regent's Park, London, N.W.1, England.

Alaskan Mountain Laboratory

The Department of the Interior has reported that a cosmic-ray research station is to be built on the plateaulike summit of Mount Wrangell, Alaska, an area that is from 13,600 to 13,800 feet above sea level and considered ideal for high-altitude research. Interior has approved a Bureau of Land Management order reserving 640 acres of public lands for the station, which will be used by the University of Alaska and other universities and scientific groups.

Plans for Accelerator

A 3×10^9 volt, high intensity-proton accelerator, which is to be built at the James Forrestal Research Center at Princeton University, is now in the final planning stage. Financed in large part by the U.S. Atomic Energy Commission, the accelerator will be used under the joint administration of Princeton and the University of Pennsylvania for unclassified basic research.

The new machine is expected to produce heavy mesons in much larger quantities than has so far been possible. The study of these and other particles produced in the accelerator may throw additional light on the question of parity conservation.

The machine will consist of an alternating-current electromagnet, measuring some 80 feet in diameter and weighing 400 tons, with a rate of cycling 100 times that of the Brookhaven cosmotron. At peak energy the rotating beam of protons will be directed at target nuclei, thereby creating an intense shower of heavy mesons, which will be studied by cloud and bubble chambers, photographic emulsions, and scintillation counters.

March Scientific Monthly

Articles appearing in the March issue of *The Scientific Monthly* are: "An international observatory," J. B. Irwin; "Silverfish, a paper-eating insect," R. Lasker; "Jungle brimstone," W. Haynes; "Scientists through adolescent eyes: what we need to know, why we need to know it," D. N. Michael; "Meteorology in the International Geophysical Year," H. Wexler. Nine books are reviewed.

Scientists in the News

PERRY W. GILBERT, professor of zoology at Cornell University, has been appointed a Guggenheim fellow and will be on leave during the spring term. Until 1 May he will be at the Lerner Marine Laboratory, Bimini, Bahamas, where he will investigate the morphology and physiology of the reproductive tract of representative elasmobranch fishes. This study is expected to extend over a 2-year period and is supported in part by a grant from the National Science Foundation.

KENNETH H. KINGDON, who first joined the General Electric Research Laboratory's staff in 1920, has been appointed manager of the laboratory's Project Analysis Section. The section will evaluate certain specific research projects from both technical and economic viewpoints. It will also participate in general company studies with the objective of bringing a contribution from physical science to those studies. Previously Kingdon has served as manager of the technical department of the Knolls Atomic Power Laboratory and manager of nucleonics and radiation research at the G.E. Research Laboratory.

ROY C. NEWTON, vice president of Swift and Company, Chicago, Ill., will receive the 1957 gold medal of the American Institute of Chemists for his leadership in food technology. The presentation of the medal will be made at the 1957 annual meeting of the institute, which is to be held at the Sheraton-Mayflower Hotel, Akron, Ohio, 22-24 May.

Newton has helped to build a research staff at Swift's that has developed hundreds of improved forms of food and food products. His personal research has contributed many processes to the food industries. In addition, under his direction, a program of Swift research fellowships has been extended to numerous colleges and universities.

Rev. Dr. HANS HOFMANN, both a theologian and a psychologist, will direct a 5-year study at the Harvard Divinity School to develop mental health training for future ministers. Hofmann has been appointed associate professor of theology, effective 1 July. He is now on the faculty of the Princeton Theological Seminary.

He will conduct a study at Harvard to develop a curriculum in religion and mental health suitable for Protestant theological schools. Similar studies will be conducted at Loyola University in Chicago and at Yeshiva University in New York. The studies are supported by the U.S. Department of Health, Education, and Welfare.

ERNEST WEBER, former director of the Microwave Research Institute, at the Polytechnic Institute of Brooklyn, has been appointed to Polytechnic's newly created administrative position of vice president for research.

On recommendation of the Committee on School Science of the American Academy of Arts and Sciences, the Elizabeth Thompson awards for outstanding science teaching in the secondary schools of New England have been presented to the following: GLENN E. AIKEN, Montpelier High School, Montpelier, Vt.; THEODORE P. EMERY, Gould Academy, Bethel, Me.; HELEN B. GREEN, Weston High School, Weston, Mass.; Sister MARY CATHERINE LABOURE, Girls Catholic High School, Malden, Mass.; PAUL W. LEGGE, Maine Central Institute, Pittsfield, Me.; EDWARD A. MOBERG, Watertown High School, Watertown, Conn.; DOUGLAS SANDS, Wellesley Junior High School, Wellesley, Mass.; ELSIE SCOTT, Northfield School, Northfield, Mass.

HERBERT C. S. THOM, for the past 2 years chief climatologist of the President's Advisory Committee on Weather Control, has returned to his former position in the Office of Climatology, U.S. Weather Bureau, Washington, D.C.

SAM C. HITE, former associate professor of chemical engineering at Purdue University, has been selected to head a new department of chemical engineering at the University of Kentucky.

ELIAS BURSTEIN of the Naval Research Laboratory, Washington, D.C., has been awarded the Washington Academy of Sciences' annual award for scientific achievement in the physical sciences. The award was made to Burstein "in recognition of his distinguished study of impurity levels and effective electron masses in semi-conductors."

Since joining the staff of NRL, where he is now head of the physics section of the crystals branch, he has been doing research on nonmetallic crystals. In recent years he has been concerned with the properties of semiconductor materials used in transistors and photoconductors.

KENNETH L. HERTEL, head of the department of physics at the University of Tennessee, has been assigned as full-time director of the university's Textile Research Laboratory, a regional laboratory supported by the U.T. Agricultural Experiment Station and the U.S. Department of Agriculture. ALVIN H. NIELSEN has succeeded Hertel as head of the department of physics.

LAURITS BJERRUM and **GIULIO PIZZETTI** have been appointed visiting professors in the department of civil engineering at Massachusetts Institute of Technology. Bjerrum, named visiting professor of soil mechanics, has been director of the Norwegian Geotechnical Institute in Oslo since 1951.

Pizzetti is an engineer specializing in concrete structures. He will work with the departments of architecture and civil engineering as visiting professor of structural engineering. He has taught at both the Polytechnic Institute of Turin, Italy, and at the School of Architecture, University of Buenos Aires. He is a member of the Italian National Council of Research and has published many papers on the subject of structures, thin shells, and pre-stressed concrete.

CLAUDE E. SHANNON, professor of mathematics at Massachusetts Institute of Technology, has received the 1956 Research Corporation award for his work in establishing a mathematical theory for communications. The award consists of an honorarium of \$2500, a plaque, and a citation.

The theory, called the "information theory," is concerned with the most efficient way to carry out the communicating process between both man and machine and man and man. Although still theoretical, the procedure has applications in the fields of television, radio, and computing machines.

JOSEPH L. MORSE has been named professor and director of the department of dermatology at New York Medical College, Flower-Fifth Avenue Hospital. He has been a member of the faculty at New York Postgraduate Medical School, New York University-Bellevue Medical Center, for 30 years and associate clinical professor of dermatology there since 1950.

JOHN PAUL of the University of Glasgow, Scotland, will direct the Tissue Culture Association's course on the principles and techniques of cell and tissue culture that is to be given at the University of Colorado School of Medicine, Denver, 1-26 July.

ROSS A. McFARLAND, associate professor of industrial hygiene at the Harvard School of Public Health, has received the 1956 John Jeffries award of the Institute of the Aeronautical Sciences "for outstanding contributions to the advancement of aeronautics through medical research." McFarland is a physiologist whose name has long been associated with the development of biotechnology, the epidemiological approach to accidents involving human beings and machines.

JOHN T. RANDALL, F.R.S., Wheatstone professor of physics and honorary director of the Biophysics Research Unit of the Medical Research Council, King's College, University of London, is spending 5 months as visiting lecturer in the Laboratory of Developmental Biology at the Rockefeller Institute for Medical Research, New York.

FRANCIS O. RICE, head of the department of chemistry at the Catholic University, has won the 1957 Hillebrand award of the American Chemical Society's Washington, D.C., section. The award will be presented on 14 Mar. at a special dinner in the Kennedy-Warren Hotel, Washington. In his award address Rice will discuss his 25 years of work on free radicals.

An expert on the structure of matter, Rice was one of the first chemists to stress the importance of free radicals in certain chemical reactions. The methods which he has proposed to measure the products formed when organic substances are broken down have gained wide attention. On the basis of his research a whole chapter in modern chemistry is being reformulated.

Three promotions on the research staff of the General Motors Corporation, Detroit, Mich., have been announced by Lawrence R. Hafstad, vice president in charge of research. **JOHN M. CAMPBELL**, who has been technical director since 1954, has been named scientific director; in this newly created position he will serve as Hafstad's principal assistant.

ARTHUR F. UNDERWOOD, who has headed the mechanical development department, was elevated to manager of research staff activities. **GREGORY FLYNN, JR.**, succeeds Underwood.

The promotions result from the retirement on 1 Mar. of **ALFRED L. BOEGEHOLD**, manager of research activities and principal assistant to Hafstad. Boegehold will continue as a consultant to the research staff following his retirement. He has been with General Motors for 36 years.

EUGENE B. FERRIS, formerly professor of medicine and chairman of the department of medicine at the Emory University School of Medicine, has been appointed medical director of the American Heart Association, New York.

HERWIG HAMPERL, director of the Institute of Pathology, University of Bonn, Germany, has been appointed visiting Carl Schurz professor at the University of Wisconsin Medical School for the spring semester. He will present lectures both at the medical school, which is in Madison, and at the university's campus in Milwaukee.

JOHN B. MACDONALD has been named director of the Forsyth Dental Infirmary for Children and professor of oral microbiology in the Harvard School of Dental Medicine. His is the first joint appointment made by the two institutions since their affiliation in May 1955. Macdonald was formerly chairman of the Division of Dental Research and professor of bacteriology in the Faculty of Dentistry, University of Toronto. His service to dentistry has embraced professional dental practice, research, and teaching.

Recent Deaths

C. GREGORY BARER, Bronxville, N.Y.; 53; staff member of the Institute of Ophthalmology of Presbyterian Hospital, Columbia-Presbyterian Medical Center and instructor at the College of Physicians and Surgeons of Columbia University; 8 Feb.

CLIFFORD R. BEARDSLEY, Huntington, N.Y.; 71; retired electric power engineer; 9 Feb.

WALTER BOTHE, Heidelberg, Germany; 66; director of the Institute of Physics at the Max Planck Institute for Medical Research and 1954 winner of the Nobel prize for physics; 8 Feb.

HENRY S. DUNNING, New Canaan, Conn.; 76; professor emeritus and a founder of the College of Dental and Oral Surgery of Columbia University; 10 Feb.

JOSEPH F. HAUCK, New Brunswick, N.J.; assistant chairman of the agricultural economics department at Rutgers University; 5 Feb.

JOHN H. HOSKINS, Cincinnati, Ohio; 61; chairman of the department of botany and bacteriology at the University of Cincinnati; 8 Feb.

HUBERT S. HOWE, New York, N.Y.; retired clinical professor of neurology at the College of Physicians and Surgeons of Columbia University; 4 Feb.

EDWARD H. HUME, Wallingford, Conn.; 80; former director of the New York Post-Graduate Medical School; head of the medical services of Yale-China 1904-10; 9 Feb.

ALBERT D. SANIAL, La Crosse, Wis.; former meteorologist with the United States Weather Bureau; 9 Feb.

LUCILLE H. SNOW, Chicago, Ill.; 58; staff member of Loyola University, Stritch School of Medicine at Loyola University; 8 Feb.

JOHN VON NEUMANN, Washington, D.C.; 53; member of the U.S. Atomic Energy Commission; 8 Feb.

Erratum: The name of the publisher, Simon and Schuster, New York, and the publication date, 1956, were inadvertently omitted from the review of James R. Newman's book *The World of Mathematics*, which appeared in the issue of 1 Feb., page 197.

Reports

Blocked Kynurenine Pathway of Tryptophan Metabolism in Hepatoma

Tryptophan metabolism is related to nicotinic acid which, like several of the B-complex vitamins, is reduced in tumor tissues (1). The concentration of coenzyme I (CoI) and coenzyme II (CoII) is relatively low in experimental and human tumors (2, 3). The concentration of coenzyme I decreases continuously in the liver of rats that are fed with *p*-dimethylaminoazobenzene (3). An increase in the reduced form over the oxidized form of coenzyme I was observed in Jensen sarcoma (4). The urinary kynurenine excretion was found to be high in cancer patients on high tryptophan diet (5). These observations suggest a disturbance in the tryptophan metabolism.

Rats of the Fisher strain (6) and C3H No. 129 mice (7), bearing transplanted hepatomas, were used in these investigations (8, 9). Homogenates of normal liver, host liver, and tumor were used to determine the tryptophan peroxidase (TP) activity and kynurenine degradation. Rat tumors were large, nonulcerated, containing necrotized parts, and the mice tumors were medium size. Only the nonnecrotized part of tumors was used. The homogenate was strained through cheesecloth before use. Knox and Mehler's method (10) was used to determine tryptophan peroxidase activity.

Because the kynureninase spectrophotometric method (10, p. 242) was found unsatisfactory for our purpose, the following procedure was used in determining kynurenine degradation. Fresh tissue was homogenized with cold 0.067M phosphate buffer at pH 7.5 (1 g of tissue/2 ml of buffer); 0.2 ml of homogenate was added with 0.4 ml of buffer, 0.2 ml of

pyridoxal phosphate (0.1 mg/ml), and 0.2 ml of 0.02M kynurenine. The tissue blanks consisted of 0.2 ml of additional buffer instead of kynurenine; the control had 0.2 ml of additional buffer instead of tissue homogenate.

Two sets of tubes were prepared for each type of mixture. One set was inactivated after 5 minutes by adding 2.5 ml of a mixture of ethanol and acetic acid, (9 parts of alcohol/1 part of glacial acetic acid). The second set was incubated for 2 hours under N_2 at 37°C, then inactivated in the same way as the first set.

The deproteinized, incubated and non-incubated samples were centrifuged, and 2 ml of the supernatant was evaporated on a steam bath. The residue was dissolved in 1 ml of 95-percent alcohol.

The mixture of alcohol and residue was centrifuged, and 0.25 ml of the supernatant was spotted over a quarter-inch area, using Whatman No. 1 chromatographic strips, 1 by 20 in. Evaporation of the sample was hastened by means of infrared heat over an atmosphere of nitrogen.

The strips, attached to glass rods with nonstaple paper fasteners, were developed by descending chromatography for 24 hours in a Chromatocab (11) (Fig. 1). The solvent used was water-saturated

butanol. After they had been dried in a fume hood, the chromatograms were sprayed with 0.25-percent ninhydrin in water-saturated butanol and heated in an oven for 15 minutes at 75°C.

The mean value of tryptophan peroxidase activity, expressed in micromoles of kynurenine per gram of dry tissue, per hour, was found to be 2.00 for normal rat liver, 3.91 for rat host liver, and 0.29 for the rat hepatoma. In the mouse, the figures were 5.20 for normal liver, 3.11 for host liver, and 0.00 for the hepatoma. In normal liver, the added kynurenine disappears before incubation (chromatogram No. 4).

The ninhydrin-reacting substances formed through degradation of kynurenine appear only after incubation (chromatogram No. 5).

Immediate disappearance of kynurenine may be explained by combination with pyridoxal phosphate under the catalytic action of normal liver homogenate. This eventual combination is absent in tumor homogenates (chromatogram No. 8). The enzyme responsible for the disappearance of kynurenine in normal liver homogenate is under investigation.

It seems that, during incubation, substances that react with ninhydrin are produced from kynurenine as it disappears. This reaction results in further transformation of ninhydrin-colorless compounds, probably by transamination with keto acids that are present or are formed during incubation; it also results in alanine formation (kynureninase action). Wiss reported kynurenine transamination (12) and alanine formation (13).

Only a small amount of ninhydrin-colored products is produced after incubation of normal liver in the absence of kynurenine (chromatogram No. 3). Neither ninhydrin-colorless nor ninhydrin-colored products are produced in

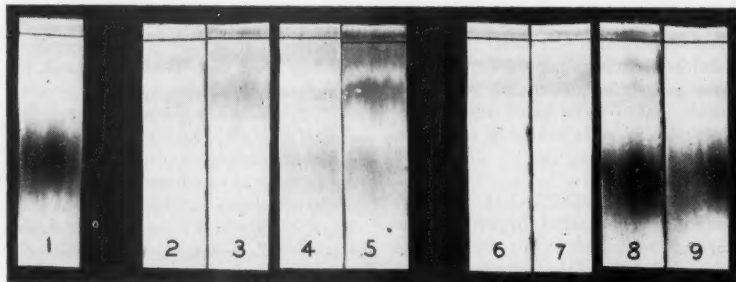


Fig. 1. Anaerobic kynurenine degradation in normal liver and transplanted hepatoma of the rat. 1, Kynurenine control without homogenate, incubated; 2, normal liver control, nonincubated; 3, normal liver control, incubated; 4, normal liver added with kynurenine, nonincubated; 5, normal liver added with kynurenine, incubated; 6, hepatoma control, nonincubated; 7, hepatoma control, incubated; 8, hepatoma added with kynurenine, nonincubated; 9, hepatoma added with kynurenine, incubated. All samples were added with pyridoxal phosphate. The incubation time was 2 hours under N_2 . The nonincubated samples were inactivated 5 minutes after kynurenine was added to the homogenate mixtures.

All technical papers and comments on them are published in this section. Manuscripts should be typed double-spaced and be submitted in duplicate. In length, they should be limited to the equivalent of 1200 words; this includes the space occupied by illustrative or tabular material, references and notes, and the author(s)' name(s) and affiliation(s). Illustrative material should be limited to one table or one figure. All explanatory notes, including acknowledgments and authorization for publication, and literature references are to be numbered consecutively, keyed into the text proper, and placed at the end of the article under the heading "References and Notes." For fuller details see "Suggestions to Contributors" in *Science* 125, 16 (4 Jan. 1957).

appreciable amount in incubated tumor homogenate, whether or not the homogenate is added to kynurenine (chromatograms No. 7 and No. 9).

The blockage of the ring opening and the blockage of the steps following the kynurenine pathway of tryptophan metabolism, reported here, indicate, in tumors, a marked decrease of tryptophan metabolism via kynurenine. A similar blockage of the ring opening was observed for histidine in hepatoma (14).

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SALVADOR GINORI

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Miami, Florida

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26 November 1956

Eastern Equine Encephalomyelitis Virus Isolated from Three Species of Diptera from Georgia

The virus of eastern equine encephalomyelitis has been isolated from Diptera four times since Kelser demonstrated that *Aedes aegypti* could transmit the virus in 1933. The significance of these isolations has been obscured by the difficulty in demonstrating experimental transmission with the species involved (1). Few would consider a species of insect a natural vector of a virus unless the virus could be isolated from it during an epizootic and unless the virus could also be transmitted experimentally by it.

The virus of eastern equine encephalomyelitis was isolated from pools of three dipterans: *Aedes mitchellae* (Dyar), *Anopheles crucians* Wiedemann, and an unknown species of *Culicoides* that were captured in southern Georgia in July 1956 (2). The isolation from *Aedes mitchellae* is probably most significant for species of this genus of mosquitoes have

been effective experimental vectors of the virus (3). Chamberlain *et al.* (4) determined the threshold of infection, the transmission rate, and the infection rate of 20 species of mosquitoes. Excellent vector potentials were shown by three species, all belonging to the genus *Aedes*. *Anopheles crucians* was rated poor. *Culicoides* were not tested.

The mosquitoes and midges were collected in modified New Jersey type light traps on farms where horses had eastern equine encephalomyelitis (5). The live insects were anesthetized by chloroform and identified as to species in the case of mosquitoes and to genus in the case of *Culicoides*. Pools of one to 20 individuals were immediately ground in Ten Broeck tissue grinders with 1 ml of sterile, distilled water containing 5000 international units of penicillin with 5 mg of streptomycin. The resultant suspensions were centrifuged, and the supernatant fluids were inoculated into the allantoic chamber of 8-day embryonated chicken eggs, six eggs usually being used per inoculum, and each egg receiving 0.1 ml of fluid (6). Following inoculation, the eggs were incubated at a temperature of 35°C for 8 days. Allantoic and amniotic fluids were harvested from all embryos that died within this period and tested for bacterial contamination on nutrient agar and in thioglycollate broth. Harvests that appeared to be bacteriologically sterile were inoculated in further series of eggs. Isolates were sent to our laboratory in Wisconsin, where they were identified by titration with and without specific antiserum.

The pool of *Aedes mitchellae* from which virus was isolated was collected on 28 July from a farm near the town of Patterson in Pierce County. Eastern equine encephalomyelitis virus was isolated from the brains of two horses on this farm. The pool of *Anopheles crucians* was collected 30 July, on a farm in Appling County. The *Culicoides* from which the isolation was made were collected 28 July on a farm in Wayne County. Virus was recovered from a horse on this farm. The isolation history is given in Table 1.

The initial inoculum of the infected insect tissue killed half or more of the

embryos after an unusually long incubation period of 69 to 144 hours. The period was reduced in the second or third passages to the characteristic time of 18 to 23 hours. The culture from *Anopheles* took four passages before all embryos were killed, and during this period the virus appeared to be sensitive to the effect of dilution and to freezing and thawing. Virus diluted in broth alone had a titer of $10^{3.5}$ as compared with its titer of $10^{3.8}$ when it was diluted in normal serum and broth. The adapted virus of the third or fourth passage of all three isolates possessed an embryo lethal titer of $10^{5.2}$ to $10^{6.2}$. Specific eastern equine encephalomyelitis antisera prepared in chickens neutralized $10^{1.7}$ to $10^{2.8}$ LD₅₀ of virus. Normal chicken sera and western equine encephalomyelitis antisera did not neutralize the isolates.

All three dipterans from which the isolations were made are common in Georgia but are not widely distributed in other parts of the United States (7). *Aedes mitchellae* seems to be limited largely to the Atlantic and Gulf coastal plains, but, unlike its salt-marsh relative *Aedes sollicitans*, it breeds in fresh-water pools. Adults and larvae are seen throughout the year in southern Georgia. The range of *Anopheles crucians* is similar to that of *Aedes mitchellae*, but it extends further north and south, having been reported from Massachusetts and Central America. Its greatest abundance is reached in the cypress swamps of Georgia and Florida, where the larvae thrive in the acid waters of the swamps. Female *Anopheles crucians* are indistinguishable from *A. bradleyi* and *A. georgianus*. *Culicoides* are prevalent along the eastern seaboard in the tidewater counties where outbreaks of eastern equine encephalomyelitis have occurred most frequently.

Although nothing has been published about *Culicoides* and equine encephalomyelitis virus, the vector efficiency of the genus has been demonstrated for the blue tongue virus of sheep, and *Culicoides* are reported to transmit African horse sickness and fowl pox viruses (8). Robert Levi-Castillo of the Public

Table 1. Isolation and identification.

Source	Passage history							
	First		Second		Third		Neutralization	
	Mortality (No.)	Incubation (hr)	Mortality (No.)	Incubation (hr)	Mortality (No.)	Incubation (hr)	Titration	EEE WEE N
<i>Aedes mitchellae</i>	3/6	144-180	2/3	40-72	3/3	18-22	5.2	1.7 0 0
<i>Culicoides</i> spp.	4/6	136-180	2/3	23			6.2	2.7
<i>Anopheles crucians</i>	3/3	69-144	4/20	24-96	1/10	24	5.8*	2.8 0 *

* Titer with normal serum; see text.

Health Service of Ecuador has described (9) the isolation of Venezuelan equine encephalomyelitis from *Culicoides*. The outbreak in Ecuador involved both men and horses.

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8 November 1956

Effect of Gravity on Flowering of Soybeans

The antagonistic effects of synthetic auxin on the flowering of short-day plants have been demonstrated by numerous workers. High levels of natural auxin within plants have also been shown to delay flowering. Fisher and Loomis (1) and Fisher (2) suggested that high concentrations of naturally produced auxin at the lower nodes of soybean are antagonistic to floral induction. They found that, with plants on long photoperiods, flowering could be induced earlier by removing young, auxin-producing leaves after 3 to 5 trifoliate leaves

had fully expanded. The complete loss of auxin-producing tissue through detopping, however, allowed active vegetative growth of the axillary buds. Such growth gave rise to high auxin levels at the lower nodes, thereby markedly delaying flowering.

Van Overbeek and Cruzada (3) showed that pineapple plants that were tipped on their sides flowered earlier than those that were grown upright. Pineapples do not behave like most short-day plants, since in them auxin has been shown to induce, rather than to inhibit, flowering (4). Apparently, then, the high auxin content in the apex of the horizontally grown plants induced earlier flowering, the auxin being concentrated in the apical regions by gravitational force. It was therefore thought that in soybeans, plants that begin to flower at the lower nodes, a similar method of growth might also cause an accumulation of auxin at the tip and subsequent lower auxin levels at the basal nodes, which would allow earlier floral induction.

Flambeau soybeans, on 18-hour photoperiods, were treated as follows: (i) in a control series, plants were allowed to grow normally; (ii) to make the plants grow downward, lead weights were placed around the stems near the tips of plants that had two mature trifoliate leaves; and (iii) lead weights were placed around the stems, near the tips, as in treatment ii, but vegetative suckers were removed as soon as they were 1 cm long. As the tips grew, the lead weights used in treatments ii and iii were moved toward the apex on the inverted stems. By the time seven or eight trifoliate leaves had fully expanded, 25 g of lead was required to keep the tips of the plants from turning upward. As the plants became older, the tips of the stems showed symptoms typical of the injury induced by an excess of externally applied auxin. Cellular enlargement and proliferation in the cortex were marked. The leaves continued to position themselves normally, resulting in a twisting of the petiole close to the stem. Enlargement of the petiole was pronounced in leaves that appeared after the sixth leaf was mature. Suckers usually grew from nodes 2 and 3.

Inverted plants flowered earlier and at lower nodes (Table 1) than the con-

trols. Removing the suckers from the inverted plants stimulated the earliest flowering.

These data show that flowering in soybeans can be geotropically influenced, and they provide further support for a theory of auxin control in flowering. Apparently the accumulation of auxin in the tip region, through gravitational force, caused a reduced level of auxin at the basal nodes, and thereby induced earlier flowering (5).

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7 November 1956

Triplet States of Biologically Active Molecules

In a recent communication concerning the probable importance of excited-state mechanisms in biological systems, and in particular the role of triplet-state energy transfer in oriented or partly oriented aqueous media, A. Szent-Györgyi (1) suggests that the mode of action of many drugs may involve interference with energy-transfer processes. As evidence for this possibility, Szent-Györgyi cites the fact that 2,4-dinitrophenol is physiologically active at similar concentrations to those at which it will quench the phosphorescence of riboflavin; he also cites other very suggestive but not conclusive *in vitro* experiments on the fluorescence of aqueous dyestuffs.

In this connection, I wish to report some observations made in 1953 but not yet published, on phosphorescence from narcotized tissue. We had been investigating (2) sensitive methods of detecting carcinogens by low-temperature fluorescence spectroscopy and the *in vivo* conditions of formation of carcinogen-protein complexes. We decided to look briefly at the low-temperature emission spectra obtainable from spontaneous tumor tissue. Aqueous tissue homogenates and ether extracts crystallized in an excess of naphthalene (which provided ordered host material) were prepared, and the emission spectra were observed at 90°K under irradiation from a mercury arc. The samples used were human tumor tissue from 15 to 20 patients. All

Table 1. Flowering of Flambeau soybeans on 18-hour photoperiods.

Treatment	Percentage flowering (days)					Lowest flowering node
	45	50	55	60	65	
Control	0	0	0	58	100	6.9
Inverted	0	44	55	78	100	4.7
Inverted, suckers removed	22	67	78	100	100	4.0

showed strong, long-lived ($>10^{-4}$ sec) emission spectra, usually in the green-yellow region of the spectrum, but this phosphorescence was tracked down in every case to the anesthetics that had been used before operation. Despite the subsequent use of samples from patients who had been subjected to a restricted anesthetic program, the anesthetic emission was always so strong that the search for any fluorescence characteristic of tumor tissue was abandoned.

The emission was observed with substances as widely different as barbiturates, morphine, hyoscine, sodium pentothal, syncurine, and *d*-tubocurarine chloride, and it was stronger than that which could be obtained from the drugs alone in concentrations as high as the maximum possibly present within the tissue.

This observation lends strong support to the view that the molecules of anesthetic act as traps for energy absorbed elsewhere in the tissue. I have already put forward the idea, in connection with a discussion of certain aspects of radiation damage (3), that most of the biologically important prosthetic groups act as such traps. The molecules of an anesthetic may thus provide traps competitive with those normally operative, and this leads to the prediction that radiation damage may be less severe on irradiation of anesthetized tissue than it is on unanesthetized tissue.

It is noteworthy that, while the triplet-level explanation is probably not directly applicable to small molecules with anesthetic properties (cyclopropane, ether), these molecules, with no exceptions so far as I am aware, are in turn oxidized to products that show phosphorescence with an exceptionally high quantum yield. We are now embarking on a more quantitative study of these phenomena.

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29 November 1956

Blocking Effect of Brain Extract on Lysergic Acid Diethylamide Reaction in Siamese Fighting Fish

The method used to study the blocking effect of beef brain extract is based on the criteria described by Abramson and Evans (1) for the reaction of the Siamese fighting fish to lysergic acid diethylamide (LSD-25). However, these criteria were modified for the purposes of this investigation (2) and are listed in

Table 1. Inhibition of LSD-25 effect by brain extract. The readings recorded in rows 1a, 2a, and 3a were made 1 hour after brain extract was added to the container, but before LSD-25 was added. The readings in rows 1b, 2b, 3b, and 5b were made 1 hour after LSD-25 was added.

Treatment	Response (No. of fish)			
	Nose up, tail down	Kink in tail	Top of water, tail up	Bottom of container
<i>Experimental containers</i>				
1a Brain extract (2 mg/ml)	0	0	4	0
1b LSD-25 (2 µg/ml)	4	4	1	2
2a Brain extract (0.2 mg/ml)	0	0	9	0
2b LSD-25 (2 µg/ml)	8*	9	0	2
3a Brain extract (0.02 mg/ml)	0	0	2	4
3b LSD-25 (2 µg/ml)	9	10	0	1
<i>Water control</i>				
4a No brain extract	0	0	3	2
4b No LSD-25	0	0	2	4
<i>LSD-25 control</i>				
5a No brain extract	0	0	3	3
5b LSD-25 (2 µg/ml)	10	10	0	0

* One fish dead.

Table 1. The main criterion utilized was the nose up-tail down position of the fish, at an angle of approximately 45 deg or more. Beef brain extract was prepared in a fashion similar to that described by Florey and McLennan (3). In general, the experiments reported here were all run similarly.

Five bottles containing 200 ml of distilled water each were used to observe 50 fish simultaneously, with ten fish in each bottle. Readings were made with two different methods every 15 minutes for a period of 4 hours or more. The effects of brain extract (2 mg/ml, 0.2 mg/ml, and 0.02 mg/ml) on the reaction of the fish to 2 µg of LSD-25 per milliliter of solution were compared with a water control (no brain extract) and an LSD-25 control (no brain extract). Table 1 presents, in general, the method of bioassay currently employed.

Until LSD-25 was added, none of the fish showed the typical nose up-tail down position except as a normal movement. Fifteen minutes after the LSD-25 was added to the five vessels, all the fish in the LSD-25 control showed the nose up-tail down position and continued to do so throughout the experiment. Essentially similar results were obtained in the bottle containing 0.02 mg of crude brain extract per milliliter. In the bottle containing 2 mg of brain extract per milliliter, by contrast, not only was the initial excitatory phase absent, but there was also a lag, with one fish showing the nose up-tail down behavior at 45 minutes and only four fish showing this behavior at 1 hour. Table 1 gives illustrative data obtained at the end of the first hour.

Using unpublished reaction-time curves, it can be readily shown that the fish in the bottle containing 2 mg of brain

extract per milliliter acted as if approximately 0.2 µg of LSD-25 per milliliter were present. In other words, the brain extract blocked the appearance of the LSD-25 effect, and when this effect finally did make its appearance it resembled that of a much weaker solution of LSD-25 than was actually added.

The question naturally arose: Is the serotonin present in brain extract responsible for the action of the brain extract? Two hours after the fish were exposed to 2 mg of serotonin per milliliter, 2 µg of LSD-25 was added. Serotonin does not block the LSD-25 reaction.

Negative results were also found with histamine and γ -aminobutyric acid, as well as with the following amino acids: *l*-hydroxyproline; *l*-serine; 3,5-diiodo-*l*-tyrosine; *dl*- α -aminobutyric acid; *dl*-cysteine hydrochloride; *l*-lysine hydrochloride; *dl*-methionine; *l*-tyrosine; *dl*-valine; *dl*-tryptophan; *l*-leucine; *dl*-phenylalanine; acetyl glycine; *l*-arginine hydrochloride; *dl*-threonine; *l*-histidine hydrochloride; *l*-glutamic acid; *l*-valine; acetyl-*dl*-phenylalanine; glycine; and *l*-proline. There was possibly slight blocking in *l*-histidine hydrochloride, for all the fish did not react to LSD-25 immediately.

Lack of material (the result of the difficulty of preparing the crude brain extract in quantity) has prevented our determining where the blocking substance acts or what it is. Conceivably, it could act in several places: (i) outside the fish, forming a loose compound with LSD-25; (ii) at the gill membrane; or (iii) inside the fish itself, as a true pharmacologic inhibitor. The data indicate that some type of equilibrium is set up in which the inhibitory action is dependent on the concentration of the LSD-25 blocking substance present in the liquid.

Future experiments are being designed on mammals and on man to estimate whether the brain extract inhibits the LSD-25 reaction as it does in the fish and whether it will affect the course of clinical psychoses. In view of the small amount of material obtained from beef brain, our present methodology is being scrutinized in an effort to obtain more of the inhibitory substances from beef brain or from other tissues and other animals. Whether the LSD-25 blocking substance is similar to Florey's synaptic inhibitor remains to be determined.

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31 December 1956

Properties of Vitamin B₁₂-like Material from *Crithidia fasciculata*

Several naturally occurring pseudovitamins of the B₁₂ series have been recognized (1). Others have been prepared by chemical degradation of cyanocobalamin (2) and by directed biosyntheses with bacterial mutants (3). The pseudovitamins B₁₂ differ from cyanocobalamin in that selected purines and benzimidazoles replace 5,6-dimethylbenzimidazole, the naturally occurring nitrogenous base of cyanocobalamin.

Although vitamin B₁₂ (and vitamin B_{12b}) appears to be the sole naturally occurring form that is metabolically active, recent data (4) obtained in our laboratory on the effect of certain biosynthetically prepared pseudovitamins B₁₂ on the growth and metabolism of parasitic protozoa suggested that in certain of these organisms there exists a functional equivalent to vitamin B₁₂, which is distinct from cyanocobalamin. This report (5) describes properties of a naturally occurring vitamin B₁₂-active material found in the hemoflagellate, *Crithidia fasciculata*.

Extracts of *Crithidia* containing the vitamin B₁₂-active material were prepared by mild acid hydrolysis (6) of washed cell concentrates. The liberated material, after removal of protein, replaces vitamin B₁₂ in the growth of *Escherichia coli* 113-3 (7), of the soil

microbacterium referred to as "Lochhead 38" (8), and of *Euglena gracilis* (9). Although these organisms have been used at various times for assay of vitamin B₁₂, they do not respond specifically to this factor. In addition to responding to vitamin B₁₂, the *Escherichia coli* mutant responds to pseudovitamins of the B₁₂ series, as well as to various products of hydrolysis of nucleic acids, and to methionine (8).

The "Lochhead 38" organism in our hands responds also to various pseudovitamins B₁₂ as well as to factor B [the B₁₂ molecule minus the 5,6-dimethyl-1-(α - β -ribofuranosyl) benzimidazole-3'-phosphate moiety (10)] but not to methionine or nucleic acid fragments. In addition to responding to cyanocobalamin, *Euglena gracilis* responds to various pseudovitamins B₁₂ (8).

The active principle in the *Crithidia* extracts does not support growth of the chrysomonad protozoan, *Ochromonas malhamensis*; this organism has been repeatedly shown to be specific for cyanocobalamin, or materials, such as factor B (11), which are clinically similar to cyanocobalamin in effectiveness as anti-pernicious anemia factors (8). The vitamin B₁₂-functioning material in *Crithidia* thus behaves on microbiological assay as a typical pseudovitamin B₁₂.

The vitamin B₁₂-functioning material has been separated by paper chromatography, and the activity has been made visible by bioautography of the chromatograms on agar plates seeded with *Escherichia coli* 113-3. Figure 1 shows a typical separation obtained in a solvent system composed of water, ammonium hydroxide, and *n*-butanol (50/1/100) at pH 10.7. In this system, vitamin B₁₂ and factor B undergo slight degradation, releasing unidentified fragments that support the growth of the *E. coli* mutant. The *Crithidia* vitamin B₁₂-functioning material is also labile in this solvent system. Chromatograms developed for various times show a continuing decrease in recovery of the *Crithidia* material that was originally applied to the paper: after development for 24 hours, essentially no activity is recovered. However, destruction of the factor, unlike the alkaline degradation of cyanocobalamin and factor B, does not release microbiologically active fragments.

The *Crithidia* material also differs from vitamin B₁₂ in its lability to acid. Chromatography in a *sec*-butanol and acetic acid solvent system at pH 3.5 for 24 hours, which has no adverse effect on cyanocobalamin or on factor B, completely destroys activity of the vitamin B₁₂-functioning material from the hemoflagellate.

All the vitamin B₁₂-like activity produced by *Crithidia* is contained within

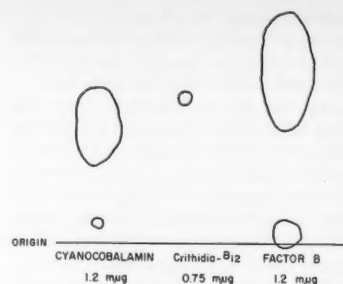


Fig. 1. Descending chromatogram of *Crithidia* vitamin B₁₂, with electrophoretically pure cyanocobalamin and factor B as standards; solvent system: *n*-butanol, ammonium hydroxide and water (100/1/50). Activity of the *Crithidia* material was assayed, before application, with *Euglena*. Development was for 18 hours at 25°C. Since the solvent runs off the paper during the extended development, *R_F* values cannot be calculated.

the cell. Concentrates of the medium in which the organisms are cultured ("the final synthetic" medium described by Cowperthwaite *et al.*, 12) are lacking in vitamin B₁₂ activity for *Euglena* and "Lochhead 38" as well as for *Ochromonas* (9, 13).

The marked acid lability of *Crithidia*-vitamin B₁₂ and the alkaline degradation without release of microbiologically active fragments like those obtained with factor B and cyanocobalamin (Fig. 1) indicate that this material does not contain factor B groups, which are common to all the known vitamins B₁₂. These observations suggest that there exists in nature an entire series of new vitamin B₁₂-functioning materials present in organisms which lack the specific vitamin B₁₂, cyanocobalamin. Preliminary results in our laboratory with materials separated from various protozoans, both free-living and parasitic, attest to this generalization.

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21 November 1956

Fallout and the Strontium-90 Hazard

In a recent paper (1) Andrews discussed the hazard from Sr^{90} where the total fission products from a nominal atomic bomb have fallen on one small area. His calculation relating to food assumes uniform dispersal of the Sr^{90} over an area of 2 square miles, and his calculation dealing with water is based on complete mixing in Lake Mead (volume, 600×10^9 cubic feet). He estimates that, to accumulate the maximum permissible body burden of Sr^{90} , a man would have to consume the fission products deposited on 4 square feet of food, or drink 50,000 cubic feet of the Lake Mead water. The latter figure has recently been cited by another author (2).

Andrews' conclusion that there is a negligible Sr^{90} hazard might be correct, but both of the calculations on which it is based are in error by two orders of magnitude. The maximum permissible body burden quoted from Handbook 52 (3) should be 1.0 microcurie (0.005 microgram) of Sr^{90} , not 1.0 microgram as he states. Andrews' estimates are therefore low by a factor of 200, and the corrected figures for human consumption are 3 square inches of food and 250 cubic feet of water.

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9 November 1956

Root-Nodule Bacteria of *Prosopis stephaniana*

The most dominant of the leguminous plants that grow wild in Iraq is *shok* or *kharnub*, *Prosopis stephaniana* (Willd.) Spreng. This plant is found in desert, in open fields, along irrigation ditches, on river banks, in orchards, and in the foot-

hills of the Iraqi mountains. It is a perennial plant with long roots. Some of the roots grow deeper than 2 m, and they branch in all directions. Some of the branches are more than 5 m long. The top shoot sheds its leaves in December, and new leaves and branches are formed in May; the plant blooms in late June and the fruits are green in color in late July, turning reddish-brown in late August.

Prosopis stephaniana seems to be a very ancient native of Mesopotamia. The old records of the Sumerians (3600–3000 B.C.) mentioned this plant and called it *eri-til-la*, meaning "the plant of the city of life." The Akkadians (3000–2300 B.C.) called it *kharubu*, which is very similar to the Arabic name *kharub* or *kharnub* (1). It is likely that the plant was in Mesopotamia earlier than is indicated by the written records so far discovered.

Winshurst (2) mentioned *Prosopis* and considered it to be an indicator of a good soil. He suggested the presence of nodulous bacteria, but he was unable to find nodules on the roots. I was able to grow *Prosopis* from seeds (3), and seedlings grown under greenhouse conditions had nodules when they were examined 3 months after planting. Microscopic examination of the nodules showed the presence of *Rhizobium* bacteria. A search was made to find young roots which might have nodules in the field. One-year old roots were found to have nodules which are reddish in color. Old roots were also found to have nodules, but they were not as conspicuous as those on the young roots. The bacterium found was motile and rod-shaped.

Rhizobium species from *Prosopis* are not mentioned in Bergey's Manual (4), and this could be a new species that has not been described before; its host is *Prosopis stephaniana*. There is another leguminous plant that is usually associated with *Prosopis*—camel thorn, *Alhagi maurorum* Medic., but the bacteria isolated from the nodules of *Alhagi* are different from those isolated from *Prosopis*. Further study is needed for the determination of these *Rhizobium* species.

Preliminary tests showed that *Prosopis* nodules contain large amounts of nitrates (5), the presence of which is attributed to fixation of the atmospheric nitrogen by bacteria. Large amounts of nitrates are being added every year to the soils of the Tigris and Euphrates valley through direct derivation from nodules and from the leaves that are shed every winter. The addition of nitrates to the soil increases the fertility of the land. The land of Mesopotamia, which has been under cultivation for more than 5000 years, is still fertile because of the

constant supply of nitrogen provided by *Prosopis* plants. Winshurst in 1920 even suggested that *Prosopis* should be cultivated in lands where it does not grow in order to increase the fertility of the soil.

The Iraqi farmers have always used the fallow system. They do not use chemical fertilizers or the crop-rotation system to enrich their lands. In the fallow system, they cultivate half their land for 1 year and the other half the second year. *Prosopis* grows on the fallow land and adds to the fertility of the soil.

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References and Notes

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4. R. S. Breed, E. G. D. Murray, A. P. Hitchens, *Bergey's Manual of Determinative Bacteriology* (Williams and Wilkins, Baltimore, Md., 1948).
5. Thanks are due to A. Sh. Abdul Wahab for his help in the nitrate determinations.

14 September 1956

Ultrasonic and Electron Microscope Study of Onion Epidermal Wall

The wall structure of the cortical cells of the root of the onion, *Allium cepa*, as observed under light and electron microscopes, has recently been described in detail (1). In this report, certain results of similar studies on the epidermis of the onion leaf are summarized. The structure of the onion leaf has been described by numerous anatomists, including Hayward (2). The gray "bloom" conspicuous on the older green blades consists of ubiquitous, minute wax rodlets about 2 to 4 μ in length, the majority 1 to 2 μ in diameter, and a minority, random in distribution, about twice this thickness. The underlying cuticle stains clearly with Sudan III.

The entire cell wall, as indicated by standard microchemical tests, consists in the main of cellulose and pectic substances. The latter are particularly abundant in a thin layer immediately beneath the cuticle. As is usual in the epidermis, the external wall of the cell is 2 or 3 times as thick as the inner tangential and the anticlinal walls. Within the living protoplasts, refringent, minute droplets of fat stainable with Sudan black (3) are seen to be most numerous next to the outer wall—that is, comparatively near the cuticle.

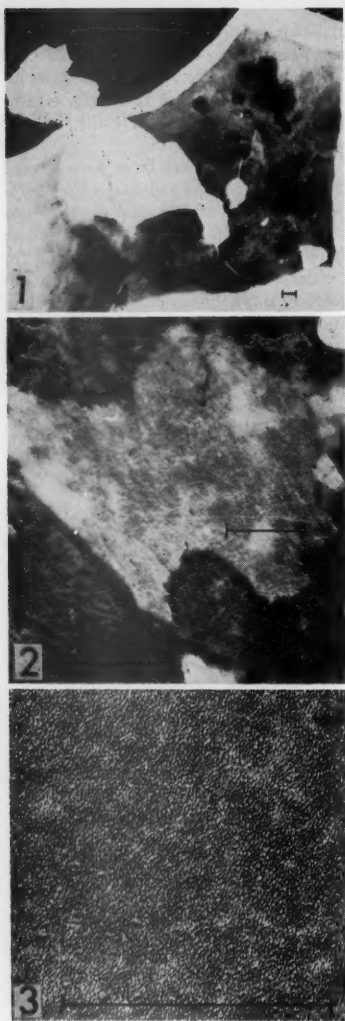


Fig. 1 (top). Outer wall with pits, after ultrasonic stripping of cuticle; white area is a fragment of cuticle. Black line, 1μ ($\times 1800$). Fig. 2 (middle). Outer wall, transition from amorphous pectic layer to underlying cellulose microfibrils. Black line, 1μ ($\times 12,750$). Fig. 3 (bottom). Cuticle isolated by pectinase treatment. Black line, 1μ ($\times 44,000$).

The distribution of wax rodlets on the surface of the cuticle indicates that pathways or canals are present in the underlying wall (4). Pits and plasmodesmata are demonstrable in material that is macerated in $\text{IKI-H}_2\text{SO}_4$. However, the

distortion, primarily shrinkage in volume and thickening of the wall, caused by this drastic chemical treatment inevitably fails to give an accurate, detailed picture of the pit distribution on each cell face.

Maceration of the epidermis without visible distortion of the tabular cells is effectively produced by ultrasonic treatment. In the ultrasonic generator at present in use, a General Electric G 3, 500,000 cy/sec, the epidermis is reduced to shreds in about 2 hours. The material, when examined under the light microscope, is seen to consist of small groups of cells, solitary cells, fringed fragments of the cell wall, and protoplasmic debris. The cuticle is partially or wholly ripped from the wall surface, torn to ribbons usually spirally coiled, or to ragged, curling platelets. Staining with Sudan III and ruthenium red gives excellent results, and pit distribution may be seen on all cell faces. When the cuticle is rolled back or torn, the pitting on the outer wall of the cell is clearly seen. These are ubiquitous, minute pits interspersed with a random scattering of somewhat larger pits. Pits are also fairly evenly distributed on all other cell faces.

Ultrasonically shattered epidermal wall fragments were prepared for electron-microscope study. Repeated washing cleared away the bulk of the protoplasm, and the shreds of wall were then mounted on grids, shadowed, and examined in the usual way. In the electron micrographs obtained, the pattern of pit distribution outlined under the light microscope is revealed in detail. In certain fragments, through luckily-placed minute tears in the cuticle, the surface of the structural cell wall may be seen. The layer immediately beneath the cuticle is amorphous and presumably consists mainly of pectic substances. Below this pectic layer, cellulose microfibrils begin to appear, and there is a gradual transition to the typically interwoven meshwork of the structural wall. A certain amount of amorphous material is present in the interstices of the cellulose mesh, and the fibrils are frequently partially enclosed in fragmentary tubular sheaths of amorphous substance (Figs. 1 and 2).

For the intensive study of the cuticle, segments were isolated by treatment of the epidermis with pectinase, or with sulfuric or chromic acid, or by bacterial action (5). Some were treated with petrol ether in order to remove the bulk

of the waxy substances, visible rodlets, and the submicroscopic platelets (6). Whatever the methods of isolation and treatment, the cuticle under the electron microscope resembles a sheet of very fine artificial rubber sponge. Neither in the onion nor in the cuticle of several other species examined is there any trace of definitive pores, equal in diameter to the wax rodlets. The appearance of the cuticle remains virtually unchanged under increasing magnification, and at $\times 16,000$ still appears to be uniform throughout (Fig. 3).

It is thus evident that the pattern of wax distribution on the onion leaf differs from that in *Mesembryanthemum* and other species (8). Since in the cuticle of the onion no definitive canals comparable in diameter to the ubiquitous wax rodlets have been observed, the mechanism of wax extrusion remains an unsolved problem. The wax precursors, in liquid form, presumably pass outward along the innumerable plasmodesmata of the external wall. Thereafter they are extruded through the apparently uniform cuticle, and, on reaching the surface, they harden into rodlet form. It is also possible that, in the turgid living cells, functional sievelike canals are actually present in the cuticle but are not observable in the dehydrated, shrunken electron-microscope preparations. This idea derives a certain amount of support from a faintly indicated mosaic pattern that is evident in certain electron micrographs (9).

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References and Notes

1. F. M. Scott *et al.*, *Am. J. Botany* 43, 313 (1956).
2. H. E. Hayward, *Structure of Economic Plants* (Macmillan, New York, 1938).
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9. A detailed account of this investigation is in preparation.

18 December 1956

Book Reviews

Stormy Life. Memoirs of a pioneer of the air age. Ernst Heinkel. Jurgen Thorwald, Ed. Translated from the German. Dutton, New York, 1956. 256 pp. + plates. \$5.

This book is the autobiography of one of the great pioneer designers and builders of aircraft, Ernst Heinkel, whose genius resulted in the world's first flight of an aircraft under rocket power alone, in the summer of 1937, and the world's first turbojet airplane flight, on 27 Aug. 1939. It is not a history of scientific and technical development of the airplane but rather an intensely interesting, human, and perhaps somewhat biased, account of the stormy resistance offered by most elements of society to the technologic innovator. As such a case history it is of value to scientists and engineers generally, especially to those who feel that conditions favorable to new ideas were to be found in greater degree in pre-World War II Germany than elsewhere.

Heinkel early demonstrated powers of creative design, an intuitive knowledge of aerodynamics and of the role of aerodynamic improvement in good performance, and a clear vision of the path of technologic progress by way of the monoplane. At first, science as such was absent. But in 1930 Heinkel discovered and recruited two "theoreticians who never flew themselves and were probably incapable of mechanical work. But they both possessed a certain 'something.' " They were Siegfried and Walter Günter, identical twins—one a mathematician, the other an artist with a flair for the proper aerodynamic shape. Thus the scientist joined the designer.

Within a few years the rugged individualist began to feel pressures from the political and bureaucratic environment in which he lived. Throughout the manifold phases of expansion of his factories, with emphasis on production and in the face of many obstacles, Heinkel contributed an amazing number of advanced designs, particularly those incorporating, for the first time, rocket and jet propulsion. The story of their slow acceptance is told in detail. In truth, science and technology exist and advance in an environment of human motivation, of human competition and conflict, as universal as the char-

acteristics of the human race. Scientists would do well to understand the interplay of these forces as well as those of the physical world with which they may prefer to occupy themselves.

HUGH L. DRYDEN
National Advisory Committee
for Aeronautics

Nouveau Traité de Chimie Minérale. vol. I, *Généralités, Air, Eau, Hydrogène, Deutérium, Tritium, Hélium et Gaz Inertes*. G. Bouissières, M. Haïssinsky, G. Pannetier, P. Pascal, R. Villard. Masson, Paris, 1956. 1097 pp. Illus.

Nouveau Traité de Chimie Minérale. vol. X, *Azote—Phosphore*. Paul Pascal and R. Dubrisay, Eds. Masson, Paris, 1956. 964 pp. Illus. Cloth, F. 7500; paper F. 6600.

In this new treatise on inorganic chemistry, the plan is to present the material in 19 volumes, which are scheduled to appear between the years 1956 and 1960. So far, volumes I and X have been published.

The first 345 pages of volume I are devoted to a general introduction that discusses such subjects as stable and radioactive isotopes, coordinate systems and phase diagrams, classification of the elements, structure of the atom, structure of ions, simple ions, complex ions, covalence, bond types, bond energies, molecular structure, macrostructure.

The next 80 pages are concerned with the composition and properties of air, followed by 140 pages on water, 122 pages on hydrogen, 233 pages on deuterium, 30 pages on tritium, 133 pages on helium and other inert gases, and 10 pages on radon.

Volume X consists of an exhaustive treatise on nitrogen and phosphorus, 713 pages of which are on nitrogen.

Each of the two volumes contains a bibliography that lists libraries in Paris and also throughout France, together with abbreviations of scientific journals, their exact titles, and the French libraries in which these journals may be found. A list is likewise given of symbols for various constants of nature and for other

physical constants used in physicochemical equations, in accordance with the recommendation of the 14th conference of the International Union of Chemistry.

The various sections of the work carry the name or names of the particular authors at the bottom of each page as well as the page on which the list of references is given. For easy consultation, the lists of references are divided into groups of ten references. Each volume has a subject index. The paper used is of good quality, and the printing is clear and pleasing. Tables and graphs are numerous.

The material of the remaining proposed volumes is distributed as follows: II, lithium, sodium, potassium; III, rubidium, cesium, francium, copper, silver, gold; IV, beryllium, magnesium, calcium, strontium, barium, radium and radioactive derivatives; V, zinc, cadmium, mercury; VI, boron, aluminum, gallium, indium, thallium; VII, scandium, yttrium, lanthanum and the lanthanides, actinium; VIII, carbon, silicon, germanium; IX, tin, lead, titanium, zirconium, hafnium, thorium; XI, arsenic, antimony, bismuth, vanadium, niobium, tantalum, protoactinium; XII, oxygen, sulfur, selenium, tellurium, polonium; XIII, chromium, molybdenum, tungsten; XIV, uranium, and the transuranic elements; XV, fluorine, chlorine, bromine, iodine, astatine, manganese, technetium, rhenium; XVI, iron, cobalt, nickel, and their simple salts; XVII, complexes of iron, cobalt, and nickel; XVIII, ruthenium, rhodium, palladium, osmium, iridium, platinum; XIX, theory and description of metallic alloys.

If completed as planned, this modern treatise on inorganic chemistry will be a welcome addition to the reference library, replacing the older publications which now are so much out of date.

RALEIGH GILCHRIST
National Bureau of Standards

Molybdenum. L. Northcott. Academic Press, New York; Butterworths, London, 1956. \$6.80.

This book is the fifth of a series on metallurgy of the rarer metals, published by Academic Press. The quality of both the print and the paper is excellent. The author has collated the information available up to the end, of 1955 on molybdenum and its alloys, and the book covers the following topics: history and occurrence in nature, extraction, processing and fabrication, physical properties, mechanical properties of molybdenum and molybdenum alloys, equilibrium diagrams of binary and ternary molybdenum systems, oxidation resistance, protective coatings and joining processes.

The author has given particular attention to the physical metallurgy of molybdenum and to the engineering properties of the metal and its alloys. Special emphasis is placed on the problems involved in the low oxidation resistance of molybdenum, the embrittlement of the metal at low temperatures, and the effects of cold working and heat treatments on its mechanical properties at low temperatures. The various types of protective coatings and available methods for joining molybdenum and its alloys are discussed in some detail.

The greatest use of molybdenum has been as an alloying element in iron and steel. This use of the element is not reviewed in the present book, since the literature on this application is very extensive and suitably covered in other books. Similarly, the specific use of the pure metal in small sections—wire and sheet—for high-temperature service in lamps and electronic valves is not included.

The presentation and arrangement of the data, in general, are very good, and the author has succeeded in keeping the size of the book down to 222 pages. Most of the 50 tables and 104 illustrations are well referenced, and this feature is appreciated by the reader who wishes to obtain further details on the different experimental investigations. Adequate references are given conveniently at the end of each chapter.

G. W. GEIL

National Bureau of Standards

The Growth and Structure of Motives.

Psychological studies in the theory of action. James Olds. Free Press, Glencoe, Ill. 277 pp. \$5.

In this series of papers the author attempts, by means of the formal, deductive approach made popular in psychology by Hull, to fashion a theory of motivation from a neurological terminology of Hebbian origin. After a brief introductory chapter, there follows a competent, but now dated, review of the experimental literature of secondary reinforcement. There is little continuity between this and the succeeding chapters, and very little future use is made of the material reviewed.

In Chapter 3 a "limited theory of reward" is presented, which culminates in a rather formal listing of postulates and definitions which allegedly constitute a "theoretical explanation of motivated behavior." We are advised at the outset of this chapter that "It is my firm belief that the techniques of measurement and variation suggested here will contribute a lasting increment to the psychology of learned motivation. . . ." However, the author fails to deliver the goods. With the possibility of one exception, he does

not even hint at techniques of measurement and in fact scarcely mentions the topic again. The primary fruits of some 19 postulates and seven definitions are a reinterpretation of a number of Tolmanian concepts and a derivation of "latent learning." Finally, he suggests an experimental "program" which yields one variable of interest.

Chapter 4 represents an attempt to interpret the structure developed in the preceding chapter "as an action system as that term has been defined by Parsons, Bales, and Shils." The analogy seems terribly strained and rather pointless. The final chapter, on the other hand, yields an interesting and sometimes ingenious discussion of the sequential properties of behavior and its temporal integration. In my opinion, the book is unlikely to be of interest to those who are not psychologists, and even among them the extent of its potential appeal is problematical.

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Books Reviewed in

The Scientific Monthly, March

The Evolution of Human Nature, C. J. Herrick (Univ. of Texas Press). Reviewed by H. S. Burr.

The Historical Background of Chemistry, H. M. Leicester (Wiley; Chapman & Hall). Reviewed by R. Siegfried.

Hailstorms of the United States, S. D. Flora (Univ. of Oklahoma Press). Reviewed by S. S. Visser.

Earth Satellites, P. Moore (Norton). Reviewed by H. E. Newell, Jr.

Things Maps Don't Tell Us, A. K. Lo-beck (Macmillan). Reviewed by W. W. Ristow.

Theory and Dynamics of Grassland Agriculture, J. R. Harlan (Van Nostrand). Reviewed by J. Hancock.

Calder Hall, K. Jay (Harcourt, Brace). Reviewed by U. M. Staebler.

Botanical Exploration of the Trans-Mississippi West, 1790-1850, S. D. McKelvey (Arnold Arboretum). Reviewed by J. Ewan.

The Earth Beneath Us, H. H. Swinerton (Little, Brown). Reviewed by H. G. Richards.

New Books

Jaarboek der Koninklijke Nederlandse Akademie van Wetenschappen 1955-1956. North-Holland, Amsterdam, 1956. 311 pp.

Heterocyclic Compounds, vol. 5, *Five-Membered Heterocycles Containing Two Hetero Atoms and Their Benzo Derivatives*. Robert C. Elderfield, Ed. Wiley, New York; Chapman & Hall, London, 1957. 744 pp. \$20.

Technical Aspects of Sound, vol. II, *Ultrasonic Range, Underwater Acoustics*. E. G. Richardson. Elsevier, Amsterdam, 1957 (distributed by Van Nostrand, Princeton, N.J.). 412 pp. \$11.75.

Reptiles. Angus d'A. Bellairs. Hutchinson's University Library, London, 1957 (distributed by Rinehart, New York). 195 pp. \$1.50.

An Atlas of Diseases of the Eye. E. S. Perkins and Peter Hansell. Little, Brown, Boston, 1957. 91 pp. \$10.

How to Use a Tape Recorder in Your Business . . . in Your Home. Dick Hodgson and H. Jay Bullen. Hastings House, New York, 1957. 216 pp. \$4.95.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, but to the publisher or agency sponsoring the publication.)

Subject Index of School of Aviation Medicine Research Reports, January 1942-December 1955. Air University, School of Aviation Medicine, USAF, Randolph AFB, Tex., 1956. 60 pp.

Laboratory Manual in General Bacteriology. Eric B. Fowler and C. H. Werkman. Burgess, Minneapolis, 1957. 103 pp. \$2.75.

Physical Society (London) Yearbook, 1956. Physical Society, London, 1956. 76 pp. 10s.

Noise Characteristics of Air Force Turbojet Aircraft. WADC Technical Note 56-280. ASTIA Document No. AD110680. Kenneth M. Eldred and Demos T. Kyrazis. Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, 1956 (order from ASTIA Document Service Center, Knott Bldg., Dayton 2, Ohio). 31 pp.

Institut pour la Recherche Scientifique en Afrique Centrale (I.R.S.A.C.), Septième Rapport Annuel, 1954. The Institute, 42, rue Montoyer, Brussels, 1956. 267 pp.

The Succession of Life through Geological Time. Kenneth P. Oakley and Helen M. Muir-Wood. British Museum (Natural History), London, ed. 3 and revised, 1956. 94 pp. 4s.

Conditioning and Sexual Behavior in the Male Albino Rat. Acta Psychologica Gothoburgensia, I. Knut Larsson. Almqvist & Wiksell, Stockholm, 1956. 269 pp. Kr. 23.

Application of Basic Science Techniques to Psychiatric Research. Psychiatric Research Repts. No. 6. Robert A. Cleghorn, Ed. American Psychiatric Assoc., Washington 6, 1956. 211 pp. \$2.

Seminole Music. Smithsonian Institution, Bur. of American Ethnology Bull. 161. Frances Densmore. Smithsonian Institution, Washington, 1956 (order from Supt. of Documents, GPO, Washington 25). 223 pp. Paper, \$1.

Plants. Instructions for Collectors. No. 10. British Museum (Natural History), London, 1957. 72 pp. 2s.

Student Mental Health: an Annotated Bibliography 1936-1955. Prepared by Daniel H. Funkenstein and George H. Wilkie for an International Conference on Student Mental Health, Princeton, N.J., 5-15 Sept. 1956. World Federation for Mental Health, London, 1956. 297 pp.

The Rockefeller Foundation Annual Report, 1955. The Foundation, New York, 1957. 350 pp.

Meetings and Societies

Program of the Gordon Research Conferences

The Gordon Research Conferences for 1957 will be held from 10 June to 30 August at Colby Junior College, New London, N.H.; New Hampton School, New Hampton, N.H.; and Kimball Union Academy, Meriden, N.H.

Purpose. The conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of scheduled lectures and discussion groups. Sufficient time is available to stimulate informal discussions among the members of a conference. Meetings are held in the morning and in the evening, Monday through Friday, with the exception of Friday evening. The afternoons are available for recreation, reading, or participation in discussion groups as the individual desires. This type of meeting is a valuable means of disseminating information and ideas that otherwise would not be realized through the normal channels of publication and scientific meetings. In addition, scientists in related fields become acquainted, and valuable associations are formed that often result in collaboration and cooperative efforts between different laboratories.

It is hoped that each conference will extend the frontiers of science by fostering a free and informal exchange of ideas among persons actively interested in the subjects under discussion. The purpose of the program is not to review the known fields of chemistry but primarily to bring experts up to date on the latest developments, to analyze the significance of these developments, and to provoke suggestions concerning the underlying theories and profitable methods of approach for making new progress.

In order to protect individual rights and to promote discussion, it is an established requirement of each conference that no information presented is to be used without specific authorization of the individual making the contribution, whether in formal presentation or in discussion. Scientific publications are not prepared as emanating from the conferences.

Registration and reservations. Attendance at the Conferences is by application. Individuals interested in attending the conferences are requested to send

their applications to the director at least 2 months prior to the date of the conference. *All applications must be submitted on the standard application form*, which can be obtained by writing to the office of the director. This procedure is important because certain specific information is required in order to make a fair and equitable decision on the application. Attendance at each conference is limited to approximately 100 individuals.

The director will submit the names of those requesting attendance to the Conference Committee for each conference. This committee will review the names and select the members in an effort to distribute the attendance as widely as possible among the various institutions and laboratories represented. A registration card will be mailed to those selected as soon as possible. Advance registration by mail for each conference is required, and registration is completed on receipt of the card and a deposit of \$15 made payable to the Gordon Research Conferences. The deposit of \$15 will be credited against the fixed fee for the conference if the individual attends the conference for which he has applied. A registration card without the \$15 deposit will not be accepted.

The board of trustees of the conferences voted to establish a fixed fee of \$100 for each conference. This fee was established to encourage attendance for the entire conference and to increase the special fund that is available to each conference chairman to assist academic and government conferees and those individuals who attend a conference at personal expense with travel or subsistence expenses, or both. The fixed fee will be charged regardless of the time a conferee attends the conference, 1 to 4½ days. It is divided as follows: registration fee, \$40 (\$15 administration and \$25 special fund); room and meals, \$60 (including gratuities). For a room with private bath or a single room (limited number available) an additional charge of \$1 per night, per person is made. These rooms will be assigned in the order that applications are received.

Members attending a conference are expected to live at the conference location because the conferences are organized to provide a place for scientists to get together informally. It is to the advantage of all participants to attend a conference for the entire week. If special

circumstances warrant living elsewhere, the conferee will be charged the registration fee of \$40 (academic conferees \$15).

The fixed fee will provide registration, room (except room with private bath or single room), meals, and gratuities. It will not provide for golf, telephone, taxi, laundry, conference photograph, or any other personal expenses.

Academic and government conferees and others on personal expense may request a reduction of \$25 (special fund) in the fixed fee. Application for this special fee (\$75) must be made when the registration card is returned to the director.

Accommodations are available for a limited number of women to attend each conference, and also for wives who wish to accompany their husbands. All such requests should be made at the time of the request for attendance, for these limited accommodations will be assigned in the order that specific requests are received. Children under 12 years of age cannot be accommodated. Dogs or other animals will not be permitted in the dormitories.

Special fund. A special fund is provided by the board of trustees from the registration fee to the chairman of each conference to assist scientists from academic and government institutions who cannot attend or participate because of financial limitations. This fund is provided with the object of increasing the participation of research workers of academic and government laboratories; it is not limited to scientists who have been invited by the chairman to attend a conference in order to present a paper. The money is to be used as an assistance fund only and may be used to contribute toward the traveling or subsistence expenses, or both, at the conference. Total travel and subsistence expenses normally will not be available.

Cancellations. The cancellation of an approved application for attendance at a conference will cause forfeiture of the \$15 deposit. This deposit will be returned only if an application is not approved.

Attendance. Requests for attendance at the conferences, or for any additional information, should be addressed to W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, Rhode Island. From 10 June to 1 September, mail should be addressed to Colby Junior College, New London, N.H.

Colby Junior College

Petroleum

Lawrence Flett, chairman

P. D. Caesar, vice chairman

10 June. Liquid phase oxidation and antioxidants, George H. Denison, chairman; J. R. Thomas, "Lube oil ox-

dation"; R. H. Rosenwald, "Gasoline oxidation"; G. S. Hammond, "Mechanism(s) of oxidation and inhibition."

11 June. Cary R. Wagner, *chairman*: Herbert C. Brown, "Directive effects in aromatic alkylation and acylation"; Norman C. Deno, "Application of acidity functions to the reactions of aliphatic hydrocarbons"; Martin Kilpatrick, "Study of aromatic hydrocarbons in highly acidic solvents."

12 June. Alkylation of isoparaffins with olefins, A. R. Goldsby, *chairman*: Ray J. Young, "New developments in propylene alkylation"; A. Schneider, "Secondary reactions in alkylation"; C. D. Slyngstad, "New aspects in alkylation"; Herman S. Bloch, "Chemistry of catalyst degradation." *Petrochemicals—oxidation processes*, A. A. Williams, *chairman*: C. W. Smith; S. D. Cooley.

13 June. Hydrogen refining, Alex G. Oblad, *chairman*: D. H. Stevenson, "Process aspects of hydrotreating of petroleum fractions"; F. Braconier, "Acetylene and acetylene compounds."

14 June. Polyethylene, Glenn A. Nesty, *chairman*: Michael E. Erchack, "Low molecular weight polyethylene"; Arthur V. Tobolsky, "New polyolefins."

Catalysis

R. L. Burwell, Jr., *chairman*

Vladimir Haensel, *vice chairman*

17-21 June. H. A. Benesi, "Titration of acidic sites on solid surfaces"; J. H. de Boer, "Microporous salt and oxide systems"; J. D. Danforth, "Cracking catalysis"; R. P. Eischens and W. A. Pliskin, "The infrared spectra of chemisorbed molecules"; H. E. Farnsworth, "Adsorption and catalysis on clean surfaces"; M. J. Joncich, "In situ methods for alteration of catalytic activity"; P. W. Selwood, "The mechanism of heterogeneous catalytic hydrogenation"; H. A. Smith, "Kinetics of hydrogenation of organic compounds and of related deuterium exchange reactions"; E. H. Taylor, "The effect of ionizing radiation on heterogeneous catalysts"; I. Wender, "Catalytic properties of metal carbonyls and related complexes"; J. C. Balaceanu, "The determination of kinetic factors in heterogeneous catalysis."

Separation and Purification

Karl Kammermeyer, *chairman*

L. C. Craig, *vice chairman*

24 June. S. Siggia, "Application of separation techniques to analytic problems"; R. C. Binning, "Liquid separation by means of barriers."

25 June. D. Frazier, "Thermal diffusion theory and practice"; E. W. Becker, part I, "Separation of isotopes by nozzles," part II, "Production of heavy water by high pressure-exchange of hydrogen and water in hot-cold columns."

26 June. Noland Poffenberger, "Crystallization"; Julian Phillips, "Separations by fractional crystallization—industrial practice."

27 June. E. F. Williams, "Gas chromatography"; R. A. Dinerstein and L. J. Schmauch, "Thermal-conductivity cells and the Martin gas-density balance"; J. Calvin Giddings, "Theoretical aspects of chromatographic separations."

28 June. R. W. Rivett, "Chromatography in pilot-plant scale—isolation of antibiotics."

Polymers

W. E. Cass, *chairman*

T. G. Fox, *vice chairman*

1 July. H. Mark, "Recent advances in polymer chemistry"; C. Sadron, "Some new developments in the polymer research field at the Centre de Recherches des Macromolécules"; D. W. Fox and E. P. Goldberg, "Aromatic polycarbonates—new high-temperature, high-impact thermoplastic resins"; R. E. Hughes, "Configuration and conformation in crystalline polymers."

2 July. C. G. Overberger, "Some aspects of homogeneous and heterogeneous ionic polymerization"; J. C. Mackey, J. B. Byrne and D. C. Feay, "Ziegler catalytic system"; C. Schuerch, "Application of polymer methods to the lignin problem."

3 July. R. Simha, "The equation of state of liquid hydrocarbons and polymers"; Y. H. Pao, "Theory of flow of polymeric liquids"; U. P. Strauss, "Properties of long-chain polyphosphates."

4 July. B. D. Coleman, "The statistics and time dependence of the creep failure of oriented polymeric filaments"; A. M. Bueche, "The strength of elastomers"; A. N. O'Neill and D. A. I. Goring, "Carageenin."

5 July. E. J. Lawton, "The importance of crystallinity in the cross-linking of polyethylene by high-energy electrons"; D. S. Ballantine, "Radiation initiated graft copolymerization studies."

Textiles

H. A. Secrist, *chairman*

E. I. Valko, *vice chairman*

8 July. W. J. Hamburger, "Yarn torque and its implications in the stability of fabrics"; E. I. Valko and G. C. Tesoro, "Durable finishing of hydrophobic textiles."

9 July. A. B. Thompson, "Strain-induced crystallization in synthetic fibers"; T. B. Lefferdink, "Interpretation of single fibre properties."

10 July. J. J. Press, "The development and structure of felted materials"; C. Harmon, "Nonwoven fabrics."

11 July. K. Weissenberg, "Some new phenomena in the behavior of viscoelastic materials"; E. Pacsu and R. F. Schwenker, "The effect of chemical

modification on the flame- and glow-resistance of cotton cellulose."

12 July. F. Fortess, "Accelerant dyeing phenomena."

Corrosion

W. D. Robertson, *chairman*

J. E. Draley, *vice chairman*

15 July. Hydrogen absorption and embrittlement, J. J. Harwood, *chairman*: M. L. Hill, "The solubility and diffusion of hydrogen in steel"; J. O'M. Bockris, "Adsorption of hydrogen on metals with reference to corrosion and embrittlement"; F. de Kazinczy, "Hydrogen absorption and embrittlement"; B. F. Brown, "Delayed fracture and hydrogen absorption."

16 July. Structure, dependent corrosion, and oxidation: D. A. Vermilyea, *chairman*: K. R. Lawless, "Structural relationships of oxide and metal in oxidation"; W. E. Tragert, "The structural factors associated with the oxidation of high-purity aluminum in water"; Earl Gulbrandsen, "Structure dependent oxidation processes"; T. N. Rhodin, "Oxidation of niobium binary alloys."

17 July. Effects of radiation on corrosion, J. E. Draley, *chairman*: M. T. Simnad, "The effects of nuclear irradiation on metal surface reactions"; G. H. Jenks, "The effect of radiation on the corrosion of zirconium." *Corrosion in water at high temperatures*, E. C. W. Peryman, *chairman*: R. A. U. Huddle, "The proton and aqueous corrosion at high temperatures"; J. E. Draley, "Behavior of aluminum and uranium in water at high temperatures."

18 July. Corrosion in water at high temperatures (continued), E. C. W. Peryman, *chairman*: M. W. Burkart, "Corrosion of uranium alloys in high-temperature water"; F. H. Krenz, "Intergranular corrosion of aluminum in high-temperature water." *Stress corrosion cracking of stainless steel*, M. A. Streicher, *chairman*: J. J. Harwood, "Current research and problems associated with cracking failures of stainless steel"; H. H. Uhlig, "Metallurgical factors in the stress corrosion cracking of austenitic stainless steel."

19 July. Stress corrosion cracking of stainless steel (continued), M. A. Streicher, *chairman*: Hugh L. Logan, "Research at the National Bureau of Standards on cracking of stainless steels"; A. W. Dana, "Corrosion cracking of stainless steels."

Instrumentation

Axel H. Peterson, *chairman*

N. B. Nichols, *vice chairman*

22-26 July. Invited papers. Clifford K. Beck, "Perspective views of reactor instrument systems"; Erik Blomgren, "Some recent trends in instrumentation in Europe with reference particularly to

the application of electronics to electrochemistry"; Charles S. Draper, Sidney Lees, Walter Wrigley, "Inertial instrumentation"; Victor P. Head, "Engineering rheology and instrumentation"; W. Lewis Hyde, "Some comments on instrumentation—illustrated by examples in microscopy"; Marcus O'Day, "Worth-while rediscoveries from 100 years ago"; H. Ziebolz, "Nonlinear and adjustable gain fluid relays."

Contributed papers. J. B. Breazeale, "Some new instruments based on magnetic suspension"; Arthur S. Brill, "A fast and sensitive magnetic susceptometer for the study of chemical reactions"; Britton Chance, "Optical measurements inside living cells"; H. R. Hegbar, "A method of achieving AGC in d-c instrument servos"; Harold A. Lamonds, "Interesting features of reactor control systems"; Gerhard Lessman, "The electronic fringe-counting linear measurement interferometer"; Arthur E. MacNeill, "The blood dialyzer viewed as a basic instrument for communication with biological systems"; J. E. McCauley, "A simple photometer for measuring the efficiency of sizing of paper"; Axel H. Peterson, "Recent developments in analytic weighing techniques"; David Z. Robinson, "Application of the evaporograph to determination of temperatures of vacuum-tube envelopes"; Jonathan R. Roehrig, "EFFI—an instrument for measuring the average diameter of wool fibers"; E. W. Silvertooth, "Computer for gas chromatography"; Harry Sohon, "A visual function-display on a digital computer."

Elastomers

E. E. Gruber, *chairman*

E. B. Newton, *vice chairman*

29 July. E. R. Erickson, R. A. Berntsen, E. L. Hill, "A study of the reaction of ozone with GR-S rubbers"; John Born, J. A. Glantz, "Effect of gamma radiation on elastomers"; E. M. Dannenberg, M. E. Jordon, "A study of carbon black in cross-linked polyethylene."

30 July. J. V. Hallum, K. A. Burgess, F. Lyon, "Carbon black surface functional groups. Their identification and effects"; Merton Studebaker, "Properties of carbon black recovered from cured rubber stocks"; P. Thirion, "Thermodynamics of rubber during reversible extension. Coefficients at constant pressure and at constant volume."

31 July. J. W. Watson, R. Jervis, "Free radical mechanism of reinforcement"; John O. Cole, C. R. Parks, "Kinetics of cross-linking of tread stocks"; L. A. McLeod and W. G. Forbes, "The dependence of tack strength on molecular properties."

1 Aug. W. M. Saltman, W. F. Gibbs, Jogiuder Lal, Bernard Wargotz, "Mechanism studies of isoprene polymeriza-

tion of Ziegler type catalysts"; H. E. Adams, "Polymerization of isoprene with aluminum alkyltitanium tetrachloride catalyst"; J. N. Short, Gerard Kraus, Vernon Thornton, "Effect of *cis-trans* ratio on the physical properties of 1,4-polybutadiene."

2 Aug. S. M. Skinner, "An experimental study of the tensile behavior of polyethylene—implications to the general theory of rubber elasticity"; Leon Talalay, Howard S. Smith, Ralph N. Kingsbury, Donald G. Dobay, "Freeze agglomeration of latex."

Medicinal Chemistry

K. E. Hamlin, *chairman*

M. B. Chenoweth, *vice chairman*

5 Aug. *Diuretic agents*: Alfred Farah; Robert F. Pitts. *Biochemistry of N-oxides*: Evan C. Horning, J. Mills, I. H. Slater, R. C. Rathbon, "Tranquilizing agents unrelated to phenothiazine."

6 Aug. *Anticholinesterase poisoning*: J. H. Wills; G. M. Steinberg. *Electric activity of single cells in the central nervous system*: Karl Frank; Theodore Bullock.

7 Aug. *Glucuronic acid metabolism*: J. Strominger, "Biosynthesis of glucuronides"; Julius Axelrod, "Physiological aspects of glucuronide conjugation"; J. J. Burns, "Effect of drugs on biosynthesis of free glucuronic acid and ascorbic acid." *Chemistry of borazene*: Harry H. Sisler.

8 Aug. *The "double-blind" test tested*: Walter Modell. *First-hand clinical drug evaluation*: Raymond W. Houde. *Structure-activity relations in antibiotics*: Paul F. Wiley, "Erythromycin"; C. R. Stephens, "Tetracyclines."

9 Aug. *Mechanisms of pharmacological action*: R. C. Park, "Insulin."

Vitamins and Metabolism

George W. Kidder, *chairman*

Lemuel D. Wright, *vice chairman*

12 Aug. F. C. Steward, "Biochemistry of growth induction"; H. P. Broquist, "Biochemistry and metabolism of 6-alkyl-8-thiooctanoic acids"; Elizabeth Work, "The metabolism and function of α,ϵ -diaminopimelic acid in bacteria"; P. A. Tavormina, "Mevalonic acid in cholesterol biosynthesis."

13 Aug. Virginia C. Dewey, "The metabolism of amino acids by *Tetrahymena*"; C. E. Dalglish, "Aspects of aromatic amino acid metabolism"; M. B. Hoagland, "Intermediate reactions in protein biosynthesis"; M. Sussman, "Some aspects of developmental physiology in cellular slime molds"; D. M. Lilly, "Factors in the growth of some omnivorous ciliates."

14 Aug. A. D. Welch, "Studies of the metabolism of pyrimidines and pyrimidine antagonists"; R. Abrams, "Some aspects of guanine nucleotide metabo-

lism"; H. L. House, "The nutritional physiology of the parasitoid dipteran, *Pseudosarcophaga*"; R. W. Newburgh and V. H. Cheldelin, "Carbohydrate metabolism in insects."

15 Aug. M. Silverman, "Metabolic transformations of folic acid"; J. C. Rabinowitz, "The role of tetrahydrofolic acid in formimino transfer"; F. H. Kratzer, "Folic acid, vitamin B₁₂, and unidentified factor studies with turkeys"; J. M. R. Beveridge, "The nature of the plasma lipid elevation and depressant factors in dietary fats."

16 Aug. Gladys Emerson, "Amino acid metabolism in rats"; B. Connor Johnson, "Vitamin metabolism in large animals."

Food and Nutrition

Harry Spector, *chairman*

Robert H. Silber, *vice chairman*

19 Aug. *Antibiotics in food preservation*, C. L. Wrenshall, *chairman*: H. L. Tarr, "Potential value of antibiotics in preservation of perishable foods"; Charles R. Stumbo, "Relation to canning and other methods of food preservation"; Henry Welch, "Public health and regulatory aspects." *Advances in mineral nutrition*, Alvin Nason, *chairman*: Robert Van Reen, "Recent developments in nutritional aspects of trace-elements metabolism"; Emanuel Epstein, "Mineral nutrition in plants—absorption and transport."

20 Aug. *Fat metabolism and atherosclerosis*, Raymond Reiser, *chairman*: Ralph T. Holman, "The biological interconversion of polyunsaturated fatty acids"; J. B. Brown, "The effect of hydrogenation on the polyunsaturated 'essential' fatty acids." Norman Jolliffe, *chairman*: Hugh M. Sinclair, "The functions of the essential fatty acids and their relationship to atherosclerosis"; Laurance W. Kinsell, "Essential fatty acids and lipid metabolism."

21 Aug. *Advances in protein nutrition*, James B. Allison, *chairman*: Richard J. Block, "Nitrogen requirements of animals and man"; Hans R. Rosenberg, "Supplementation of foods with amino acids." *Nutrition in liver disease*, Klaus Schwarz, *chairman*: Philip K. Bondy, "Carbohydrate metabolism in liver disease"; Charles S. Davidson, "Some aspects of protein utilization and metabolism in liver disease."

22 Aug. *Preservation of food by ionizing radiations*, Bruce H. Morgan, *chairman*: Don E. Young, "Problems and methods of industrial and experimental application"; W. Dexter Bellamy, "Action of ionizing radiations on proteins and enzymes"; A. L. Tappel, "Action of ionizing radiations on fats and vitamins"; Z. I. Kertesz, "Action of ionizing radiations on carbohydrates"; B. S. Schweigert, "Action of ionizing radiations on meats"; Bruce H. Morgan, "Action of

ionizing radiations on other foods"; L. L. Kempe, "Microbiological problems in preserving foods by ionizing radiations"; speaker to be announced, "The wholesomeness of irradiated foods"; B. E. Proctor, "Industrial potential of food preservation by ionizing radiations."

23 Aug. *Operations research*. Bernard E. Proctor, "Operations research. Why? When? How?"; Robert Brown, "Fundamentals of operations research"; Arthur H. Smith, "Applying operations research in the food industry."

Cancer

Arthur Kirschbaum, *chairman*

Hans Schlumberger, *vice chairman*

26 Aug. F. Bang, *chairman*: T. C. Hsu, "Mitosis in human cell strains (tissue culture) derived from nonmalignant tissues"; D. Fawcett, "Electron-microscope studies on the Lucké renal adenocarcinoma"; E. A. McCulloch, "Electron microscopy of normal and leukemic cells from human bone marrow." H. Rusch, *chairman*: G. Lester, "Aspects of hormonal control of permeability"; O. Hechter, "Possible role of the cell membrane in the cancer problem."

27 Aug. J. Furth, *chairman*: R. Guillemain, "The hypothalamus in the regulation of anterior pituitary function"; K. Clifton, "Mammotropes in relation to mammary cancer"; R. L. Noble, "Hormone-dependent mammary tumors in the rat." A. Segaloff, *chairman*: R. Hertz, "Endocrine approaches to the cancer problem"; B. J. Kennedy, "The role of the pituitary gland in human breast cancer"; E. D. Murphy, "Cervical carcinogenesis in the mouse: effects of stilbestrol and methylcholanthrene."

28 Aug. W. U. Gardner, *chairman*: P. Talalay, "Enzymatic mechanisms in steroid metabolisms"; C. Villee, "Antiestrogens"; A. Cohen and E. Bloch, "In vitro assays for function and responsiveness of adrenal tumors." L. W. Law, *chairman*: A. C. Upton, "Induction of myeloid leukemia by x-rays"; H. S. Kaplan, "Role of the thymus in the genesis of experimental lymphoid tumors in mice"; D. Metcalf, "Lymphocytosis factor of the thymus."

29 Aug. A. Kirschbaum, *chairman*: M. Potter, "Biologic characterization of reticular neoplasms of mice"; C. J. Dawe, "Tissue culture of reticular neoplasms of mice"; S. O. Schwartz, "Etiology of leukemia: filterable agents." H. S. Kaplan, *chairman*: W. E. Heston, "Localization of gene effects in carcinogenesis"; J. J. Trentin, "Irradiation, protection by bone marrow and histocompatibility."

30 Aug. H. Schlumberger, *chairman*: B. Amos, "Immunologic factors in the rejection of tumor homografts"; R. T. Prehn, "Isologous immunity to methylcholanthrene-induced sarcomas."

New Hampton School

Chemistry and Physics of Liquids Relaxation Phenomena

T. A. Litovitz, *chairman*

Ernest B. Yeager, *vice chairman*

10 June. Malcolm Brachman, "Generalized relationship between absorption and dispersion in linear systems"; Herbert Callen, "Statistical fluctuations and relaxation"; Philip W. Anderson, "Study of molecular motions through the breadth of magnetic resonance lines."

11 June. Bruno Zimm, "Relaxation effects in dilute polymer solutions"; T. A. Litovitz, "Compressional and shear relaxation in liquids"; Karl F. Herzfeld, "Thermal relaxation in liquids"; John Lamb, "Rotational isomeric relaxation in liquids."

12 June. C. P. Smythe, "Dielectric relaxation and structure of liquids"; J. Hoffman, "A barrier model for dielectric relaxation"; R. Cole, "Some problems of dielectric relaxation in liquids"; D. Denney, "Dielectric relaxation in alkyl halides and their solutions in other liquids."

13 June. M. Eigen, "Chemical relaxation in solutions"; A. Patterson, "Equilibrium phenomena as studied by high-field conductance measurements"; Eugene Gross, "General theory of dielectric relaxation."

14 June. H. S. Gutowski, "Nuclear magnetic relaxation in liquids and solids"; R. C. Torrey, "Nuclear relaxation by diffusion."

Metals at High Temperatures

Nicholas J. Grant, *chairman*

John Frye, *vice chairman*

17-21 June. *Theories of creep. Strain-induced voids and their effect on creep. Stress-induced cracks and their effect on creep. Mechanisms of void formation by corrosion. Void formation in reactor materials. Void formation in oxidation. Theories of dispersion hardening. Discussions of dispersion hardening. Ceramic-rich alloys. Metal-rich (ceramic-containing) alloys. Multiphase alloy systems. Structure stability and property changes of multiphase systems. Requirements of missile materials.*

Coal

John Mitchell, *chairman*

Alfred R. Powell, *vice chairman*

Carbonization of Coal and Nature and Structure of Cokes

24 June. *The nature of coking coals and the coking principle: Petrology and physical fine structure of coking coals.* W. Spackman, "The maceral concept in coal petrology"; A. H. Brisse, "Comments on the industrial significance of coal petrography"; J. A. Harrison, "Coal petrography and methods of petrographic

analysis as related to the study of the coking character of coal." Chemical structure of coking coals as disclosed by recent and newly developed methods of investigation: H. E. Blayden, "Molecular weight studies of soluble constituents of coal"; N. Berkowitz, "Study of coal pyrolysis by differential thermal analysis"; B. C. Parks, "Chemical and physical properties and thermal behavior of maceral components of coals."

25 June. Rheological properties of coking coals and their determination: I. A. Breger, "Effects of pile radiation on coal"; E. D. Pierron and O. W. Rees, "Components of coal responsible for the plastic characteristics"; R. J. Friedrich and G. L. Barthauer, "Effect of high rates of heat transfer on the plastic properties of coal." The carbonization process. Primary elements of the carbonization process: H. L. Riley, "Solid complexes of carbon with oxygen, nitrogen and sulfur"; C. G. Thibaut, subject to be announced; B. W. Naugle, "Fluidized low-temperature carbonization: Operating variables affecting yields and quality of tar and its vapor-phase cracking."

26 June. Secondary stages of carbonization and the formation of coke: D. J. E. Ingram, "Trapping of electrons and free radicals during the carbonization of coals"; H. L. Riley, "Study of carbonization in a small (20 lb) experimental oven"; Roger Loison, "Mechanism and factors in the fissuring of coke." Effect of kinetics and other operating variables on the nature of coke; effects of special ingredients and of pretreatment of coal: J. B. Gayle, "Effects of operating variables on the coking process"; H. W. Jackman and F. H. Reed, "Influence of coking time on expansion pressure and coke quality"; I. A. Hall, "Additives and pretreatment of coal."

27 June. Nature of coke. Macro- and micro properties of coke; their assessment and their relation to the utilization of coke: R. L. Bond, "Ultrafine capillary structure of carbonized coals"; R. Diamond, "Investigations of certain cokes using new x-ray techniques"; F. L. Shea, "Microscopy of polished coke sections." Reactivity and other chemical properties; their assessment and their relation to the utilization of coke: A. Dahme, "Nature of coke"; K. Hedden for E. Wicke, "Reactivity of graphitic carbon in combustion and gasification."

28 June. M. Mentser, "Absolute reactivity, its relation to the reaction mechanism and physical properties." Summaries by section chairmen.

Proteins and Nucleic Acids

C. B. Anfinsen, Jr., *chairman*

Paul C. Zamecnik, *chairman-elect*

1-5 July. *Covalent structure of proteins*, William Stein, *chairman*: C. H. W. Hirs, "Structure of ribonuclease";

Roger Herriott and Helen Van Vunakis, "Studies on the structure of pepsin"; C. H. Li, "Current developments in the studies of protein and peptide hormones." *Theoretical and experimental aspects of the tertiary structure of proteins in solution*, J. T. Edsall and J. M. Sturtevant, *chairmen*: J. A. Schellman, "Optical rotation and protein configuration"; Donald Fitts and John G. Kirkwood, "Optical activity of helical molecules"; W. F. Harrington, "Configuration properties of polypeptides"; William Moffett, "On optical rotatory properties"; Harold Scheraga, "Role of tertiary structure in the reactions of several proteins"; P. Doty, C. Tanford, J. T. Edsall, A. Rich, other contributors and discussers. Round-table discussion, K. Lindstrom-Lang, *moderator*: *Structure of proteins in solution. Protein structure in relation to function*, F. Haurowitz and P. Zamecnik, *chairmen*: E. Katchalski, "Biological and biochemical properties of poly-alpha-amino acids"; Hans Neurath and Gordon H. Dixon, "Chymotrypsinogen and trypsinogen: Mechanism of activation and the nature of the catalytic site"; Robert L. Hill and E. L. Smith, "Present information concerning the active site of papain"; Michael Sela and C. B. Anfinsen Jr., "On the structure of ribonuclease activity"; I. J. Harris, "On the structure and activity of melanocyte-stimulating and adrenocorticotrophic polypeptides"; I. I. Geschwind, "Isolation, properties and structure of melanocyte-stimulating hormones of various species"; R. K. Brown, L. Levine and H. Van Vunakis, "Immunochemical properties of ribonuclease in relation to its structure"; G. Perlmann, "Studies on pepsin." Round-table discussion. *Structure in relation to function*: R. R. Porter, "How far may a protein be degraded without losing its specific biological activity?" *Genetic basis of protein structure; Molecular basis of evolution*, F. Zamenhof, *chairman*: Seymour Benzer, "Genetic fine structure"; R. D. Hotchkiss and A. H. Evans, "Genetic control of pneumococcal sulfonamide resistance by specific DNA"; N. H. Horowitz, "Genetic study of proteins."

Radiation Chemistry

C. J. Hochanadel, *chairman*
W. H. Hamill, *vice chairman*

8 July. *Primary processes*, Henry Linschitz, *chairman*: M. Kasha, "Molecular excitation"; G. Porter, "Studies of primary photoprocesses and intermediates in aromatic systems." *Intermediate processes*, Robert Platzman, *chairman*: H. S. W. Massey, "Reactions of gaseous ions"; M. Burton, "Mechanisms of energy transfer."

9 July. *Gaseous ions and their reactions*, Ellison Taylor, *chairman*: Seymour Meyerson, "Hydrocarbon ions in

the gas phase"; F. W. Lampe, "Reactions of gaseous ions"; V. H. Dibeler, "The formation of negative ions by electron impact." *Gas phase reactions*, T. W. Davis, *chairman*: M. Zelikoff, "Recent developments in vacuum ultraviolet photochemistry"; Leon M. Dorfman, "Radiolysis of ethane and other gases: isotopic and scavenger studies."

10 July. *Organic systems I*, Robert H. Schuler, *chairman*: Harold A. Dewhurst, "The radiolysis of branched-chain alkane liquids"; James Caffrey, "Gas yields from hydrocarbons irradiated on solid inorganic adsorbents"; Edgar Collinson, "Radiation effects in nonaqueous solutions." *Organic systems II*, J. G. Burr, Jr., *chairman*: brief reports on recent research on the radiolysis of organic materials.

11 July. *Polymerization and polymers*: A. Henglein, "The effects of various solutes on the radiation-induced degradation of polymethylmethacrylate in solution." *Aqueous systems I*, A. O. Allen, *chairman*: Warren M. Garrison, "Radiation-induced oxidation and reduction in aqueous systems." Brief reports on recent research on the radiolysis of aqueous systems.

12 July. *Aqueous systems II*, T. J. Hardwick, *chairman*: T. J. Sworski, "Primary processes in the radiolysis and photolysis of ceric sulfate solutions"; James L. Weeks, "The photochemistry of aqueous systems"; Harold A. Schwartz, "The effect of ionization density on yields in aqueous solutions."

Organic Reactions and Processes

Harvey J. Taufen, *chairman*
Richard T. Arnold, *chairman-elect*

15-19 July. C. K. Bradsher, "New aromatic systems containing quaternary nitrogen"; D. J. Cram, "The stereochemistry of electrophilic aliphatic substitution"; L. Errede, "Preparation and reactions of solutions of *p*-xylene"; Evan F. Evans, "An ionic polymerization of acrylonitrile"; J. L. Franklin, "Reactions of ions with organic molecules in the gas phase"; C. G. B. Garrett, "Semi-conductors in organic and inorganic chemistry"; N. G. Gaylord, "Organic reactions involving complex metal hydrides"; Otto Horn, "Reactions of crotonic aldehyde"; P. R. Johnson, "The development of processes for the production of chloromethanes"; Nathan Kornblum, "The contrasting reactions of silver and alkali metal salts with alkyl halides. The alkylation of ambident anions"; W. B. McCormack, "Reactions of dienes with phosphorus compounds"; F. Weygand, "Syntheses of peptides with the help of N-trifluoroacetylated amino acids and the degradation of peptides with trifluoroacetic anhydride"; J. Whetstone, "A study of the tollens condensation of formaldehyde

with acetaldehyde"; R. W. Young, "Some aspects of the chemistry of alkylthiophosphoric acids and their derivatives."

Microbiological Deterioration

A. D. Lohr, *chairman*

22 July. *Structure-activity relationships among antimicrobial substances*, Harold G. Shirk, *chairman*: George L. McNew, "The front-line defense against deterioration of material"; Fred E. Hahn, "The role of stereospecificity in structure-activity relations among antimicrobial substances"; A. E. Dimond, *chairman*: D. W. Woolley, "The antimetabolite approach to chemotherapy"; Walter Nickerson, "Pathways of fungus metabolism subject to chemical blocking."

23 July. *Deterioration problems posed by soil microorganisms*, Orville Wyss, *chairman*: O. Wyss, "An introduction to soil microbiology"; Robert L. Starkey, "Some sulfur transformations by soil microorganisms"; E. L. Schmidt, "Cellulose decomposition in the soil"; Arthur M. Kaplan, "Comments regarding soil burial tests for evaluating preservatives"; E. O. Bennett, "Microbial development and control in cutting oils"; William L. Owen, "Microbial deterioration of colloidal additives to drilling fluids."

24 July. *Behavior of fungicides after application*, Saul Rich, *chairman*: Edward Abrams, "Factors influencing the loss of fungitoxics from wood and fabrics"; Colin H. Bayley, "Weathering loss of fungicides applied to textiles"; Saul Rich, "The dynamics of fungicide spray deposits and weathering in the field"; Harry P. Burchfield, "The persistence of fungicidal spray deposits"; John E. Rutzler, Jr., "Surface forces influencing adhesion of fungitoxic materials."

25 July. *Microbiological deterioration problems in the marine environment*, A. P. Richards, *chairman*: Claude E. ZoBell, "Manifestations and methods of measuring microbiological deterioration of man-made structures"; Lloyd Snoke, subject to be announced; Claude E. ZoBell, "Microbial corrosion of iron, steel, concrete and coating materials in the marine environment"; Bryce Prindle, subject to be announced.

26 July. Milton Goll, *chairman*: Arthur M. Kaplan, "Preservatives used for the prevention of deterioration of material—a summation of the current position."

Statistics in Chemistry and Chemical Engineering

John C. Whitwell, *chairman*
Frank Wilcoxon, *vice chairman*

29 July. C. Daniel, *chairman*: H. M. Hulburt, "Designing experiments to test the form of chemical rate equations." C.

Holloway, Jr., *chairman*: E. J. Williams, "Experimentation to test complex chemical hypotheses."

30 July. D. B. DeLury, *chairman*: M. B. Wilk, "Selecting proper mathematical models." S. L. Crump, *chairman*: W. G. Cochran, "Combining information from several experiments."

31 July. O. A. Kempthorne, *chairman*: D. R. Cox, "Events occurring haphazardly in time." H. C. Sweeny, *chairman*: B. Epstein, "Life testing and extreme values."

1 Aug. R. Bechhofer, *chairman*: F. J. Anscombe, "Transformations." Panel discussion: "Problems of the scientist and statistician." F. Wehrhritz, *moderator*.

2 Aug. J. S. Hunter, *chairman*: G. E. P. Box, "Iterative experimentation."

Steroids and Related Natural Products

J. Fried, *chairman*

G. Stork, *vice chairman*

5-9 Aug. S. Bernstein, "Recent work in the field of 16-hydroxylated corticoids"; G. Ourisson, subject to be announced; V. Prelog, subject to be announced; J. N. Shoolery, "Applications of NMR to problems in natural products chemistry"; H. Schmid, subject to be announced; R. Tschesche, "C₂₁-steroids in the plant kingdom"; F. Weisenborn, "Recent synthetic work in the field of *Rauwolfia* alkaloids"; W. C. Wildman, "Recent studies in the field of Amaryllidaceae alkaloids"; speaker to be announced, "The chemistry of gibberellic acid."

Analytical Chemistry

E. W. Balis, *chairman*

Louis Gordon, *vice chairman*

12 Aug. Alan R. Powell, "The preparation of ultrapure metals"; Frank A. Bovey, "The physical and chemical analysis of polymers and polymerizing systems."

13 Aug. F. H. Stross, "Gas-liquid partition chromatography"; M. J. O'Neal, "Analytic mass spectrometry of heavy organic molecules"; H. A. Laitinen, "Microelectrode techniques in fused-salt electrochemistry."

14 Aug. V. A. Fassel, "Emission spectrometric determination of oxygen, nitrogen, and hydrogen in metals and analytic spectroscopy of the newer metals"; H. A. Liebhafsky, "X-ray absorption and emission in chemical analysis."

15 Aug. James I. Hoffman, "Inorganic wet analysis." Open discussion.

16 Aug. Charles A. Horton, "The analysis and chemistry of fluorides."

Inorganic Chemistry

S. Y. Tyree, Jr., *chairman*

H. B. Jonassen, *vice chairman*

19 Aug. *Crystal field theory applied to metal coordination compounds*, R. G. Pearson, *chairman*: L. E. Orgel, "Crys-

tal field theory applied to spectra of complexes"; D. S. McClure, "Thermodynamic aspects of crystal field theory"; F. A. Cotton, "Structural aspects of crystal field theory"; J. S. Griffith, topic to be announced.

20 Aug. *Mechanisms of substitution reactions of coordination compounds*, F. Basolo, *chairman*: A. W. Adamson, "Photocatalyzed reactions of metal complexes"; D. S. Martin, Jr., "Reactions of square complexes"; F. P. Dwyer, "Synthesis and reactions of ruthenium complexes"; R. G. Wilkins, "Exchange reactions of coordination compounds."

21 Aug. *Applications of physical methods to inorganic chemistry*, C. F. Callis, *chairman*: C. F. Callis, "High-resolution nuclear magnetic resonance spectroscopy in structural and kinetic studies in phosphorus chemistry"; Ralph Livingston, "Applications of paramagnetic resonance and nuclear quadrupole spectroscopy to inorganic chemistry"; Ellis Lippincott, "Raman and infrared spectroscopy"; J. R. VanWazer, "Determination of bond types by various physical techniques."

22 Aug. *High-temperature chemistry*, P. W. Gilles, *chairman*: speakers and subjects to be announced.

23 Aug. *High temperature chemistry*, P. W. Gilles, *chairman*: speakers and subjects to be announced.

Adhesion

D. K. Rider, *chairman*

G. W. Koehn, *vice chairman*

26 Aug. T. W. DeWitt, "Rheology of polymer solutions"; W. W. Riches, "Titanium esters as adhesion promoters."

27 Aug. J. J. Chessick, "Adhesion of monolayers to solids"; W. K. Asbeck, "Adhesion of organic coatings."

28 Aug. C. S. Schildknecht, "Polymer structures in relation to adhesion." *Bonding of difficult adherends*: H. Peters, "Polyethylene"; C. M. Hobson, Jr., "Fluoroethylene polymers."

29 Aug. T. G. Fox, "Viscoelastic behavior of amorphous polymers"; A. T. Spencer, "Adhesion to oxide films on copper."

30 Aug. C. S. Maxwell, "The adsorption of melamine resin colloid by cellulose."

Kimball Union Academy

Lipide Metabolism

Warren M. Sperry, *chairman*

10 June. *Chemistry and structure of lipoproteins*: Frank R. N. Gurd, "Composition and physical properties of lipoproteins"; Frank Lindgren, "Preliminary concepts of low-density lipoprotein structure"; Joel Avigan, "Some properties of the lipoprotein complex." *Absorption of fat*: F. H. Mattson, "The absorption of fat"; Raymond Reiser, "Interesterification of glycerides during fat digestion and absorption."

11 June. *Lipid transport I*: Jules M. Weiss, "Some electron microscopic observations on the transport of fat across the duodenal absorption cell of the albino mouse"; Donald Zilversmit, "Turnover and transport of blood triglycerides"; Joseph H. Bragdon, "The fate of chylomicra." *Lipid transport II*: Richard Havel, "Serum lipoproteins and fatty acid transport"; Robert S. Gordon, Jr., "Recent studies of metabolism of unesterified fatty acids in normal human subjects."

12 June. *Unsaturated fatty acids and fat metabolism*: Henrik Dam, "The interrelationship of various kinds of fats with essential fatty acids and cholesterol"; Edward Ahrens, "Influence of unsaturated fatty acids on human blood lipids"; James Mead, "The essential fatty acids—metabolism and mechanism of action." *Fat synthesis I*: Salih J. Wakil, "Studies on the mechanism of fatty acid synthesis by soluble enzyme systems"; Phillip Hirsch, "Synthesis of triglycerides."

13 June. *Fat Synthesis II*: A. T. James, "The synthesis of lipids by the human red cell"; Felix Hausberger, "The regulation of growth and metabolism of adipose tissue by dietary and hormonal factors"; John Van Bruggen, "Lipogenesis: Interpretation of tracer data." *Phospholipid metabolism*: Roger Ros-siter, "Metabolism of phosphotides *in vitro*"; Donald J. Hanahan and John C. Dittmer, "Certain aspects of fatty acid metabolism."

14 June. *Cholesterol metabolism*: Carleton R. Treadwell and others, "Absorption of cholesterol via lymphatic pathways"; David Kritchevsky, "Effect of various dietary components on cholesterol metabolism."

Cell Structure and Metabolism

A. W. Pollister, *chairman*

M. J. Moses, *vice chairman*

17 June. *Metabolism of chromosomes*: G. Rudkin, "Nucleoprotein composition of puffs of salivary chromosomes of *Diptera*"; P. M. B. Walker, "Studies of DNA synthesis in single cells"; J. H. Taylor, "Autoradiographic studies of chromosome metabolism."

18 June. *Metabolism of the interphase nucleus*: L. Goldstein, "Autoradiographic studies on nuclear transplantation in *Amoeba*"; H. H. Swift, "The nuclear membrane region in growing cells"; A. K. Laird and A. D. Barton, "Biochemical studies of isolated nuclei"; V. Allfrey, "Protein synthesis in isolated cell nuclei."

19 June. *Protein and nucleic acid synthesis in the cytoplasm*: J. Brachet, "Relation of ribonucleic acid metabolism to protein synthesis"; G. Palade, "Interrelations of cytoplasmic structures in protein synthesis"; J. Scott, "Synthesis and interrelations of RNA in the cytoplasm."

20 June. *Structure and metabolism of chloroplasts*: R. Sager, "Chloroplast structure and photosynthesis in *Chlamydomonas*"; F. Ruch, "Microspectrophotometric studies of chloroplasts"; D. I. Arnon, "The chloroplast as a synthetic unit."

21 June. *Mitochondria and Golgi apparatus*: A. J. Dalton, "Structure and chemical composition of the Golgi apparatus"; B. Chance, "Respiratory enzymes of cell particles"; B. C. Pressman, "Dynamic relationships between intra- and extramitochondrial relationships."

Nuclear Chemistry

Earl K. Hyde, *chairman*

Nathan Sugarman, *vice chairman*

24-28 June. *Present evidence for the electronic structure of the actinide elements from spectroscopy, magnetic susceptibility, paramagnetic resonance, and so forth. Radiochemical studies of high-energy nuclear reactions. Machine Monte Carlo calculations of the nuclear cascade in high-energy reactions. Recent experimental and theoretical work on the fission reaction. Radiochemical techniques. Absolute counting methods.* Speakers and detailed program, including possible additional topics, to be announced.

Solid-State Studies in Ceramics

H. O. Thurnauer, *chairman*

M. L. Kronberg, *vice chairman*

1 July. J. B. Wachtman, "Sonic measurements on ceramic oxides at high temperatures"; J. H. Westbrook, "The temperature dependence of hardness of refractory compounds"; Earl Parker, "The ductility of ceramics."

2 July. C. E. Marshall, "Cation exchange of feldspar and other mineral surfaces"; A. S. Michaels, "Studies of the mechanism of peptization of kaolinite by polyphosphates"; Hakon Flood, "Equilibria studies between Fe(II) and Fe(III) in a mixed solid oxide phase."

3 July. C. E. Birchenall, "Diffusion in oxides"; V. K. LaMer, "Nucleation"; J. O'M. Bockris, "Structures of molten silicates"; W. L. Roth, "Structures of magnetic solids."

4 July. S. S. Cole, "The chemistry of titanium oxides"; E. J. Huibregtse, "Electromechanical properties of single crystals of barium titanate." Panel discussion, *Dielectrics*, E. C. Henry, *chairman*.

5 July. A. Von Hippel, "Ferroelectrics and ferromagnetics."

Chemistry and Physics of Metals

A. S. Nowick, *chairman*

E. S. Machlin, *vice chairman*

8 July. *Visual observation of dislocations*, B. Chalmers, *chairman*: P. Hirsch, "Electron optical studies of the arrangement and movement of dislocations in thin films"; J. J. Gilman, "Visual measurements of the mobility of dislocations

in lithium fluoride crystals." Panel discussion, *Observation of dislocations*, J. C. Fisher, *chairman*: W. C. Dash, F. W. Young, Jr., M. Abrahams, J. Washburn, panel members.

9 July. *Irradiation effects I*, H. B. Huntington, *chairman*: G. H. Vineyard, "Theory of irradiation displacements"; R. Smoluchowski, "Irradiation effects in the alkali halides." *Irradiation effects II*, K. G. McKay, *chairman*: K. Lark-Horovitz, "Irradiation effects in semiconductors"; J. H. Crawford, Jr., "Irradiation effects in nonmetallic crystals."

10 July. *Irradiation effects III*, C. Wert, *chairman*: J. A. Brinkman, "Comparison of existing models for defect production and migration in metals"; A. Sosin and C. J. Meechan, "Electron irradiation of metals"; M. D. Fiske, "Electron irradiation of metals." *Irradiation effects IV*, G. J. Dienes, *chairman*: T. H. Blewitt, "Recent irradiation experiments on metals at Oak Ridge"; R. W. Balluffi, "Recent irradiation experiments on metals at Illinois."

11 July. *Properties of dislocations*, W. T. Read, Jr., *chairman*: A. Seeger, "Some recent developments in dislocation theory"; K. Lucke, subject to be announced; D. O. Thompson, "Irradiation effects on Young's modulus and internal friction of copper crystals." A. S. Nowick, *chairman*: W. Dekeyser, "Recent work on lattice imperfections at Ghent."

12 July. Panel discussion, *Interaction between point defects and dislocations*, R. Thomson, *chairman*: J. E. Bauerle, A. E. Roswell, R. Maddin, R. R. Colman, panel members.

Chemistry, Physiology, and Structure of Bones and Teeth

D. Harold Copp, *chairman*

D. Dziewiatkowski, *vice chairman*

15 July. *Fine structure of bones and teeth*, Robert A. Robinson, *chairman*: Isidore Gersh, "Fine structure of connective tissue." William F. Neuman, *chairman*: M. J. Dallemagne, "Radiocalcium studies of bones and teeth *in vitro*."

16 July. *Parathyroids and regulation of blood calcium*, Franklin C. McLean, *chairman*: Roy V. Talmage, "Calcium regulation in the rat studied by intraperitoneal lavage"; Gordon S. Stewart, "The role of parathyroids in calcium homeostasis"; D. Harold Copp, "Regulation of blood calcium in the dog." Wallace D. Armstrong, *chairman*: Bertil Lindquist, "Studies on calcium and phosphorus kinetics in man."

17 July. *Radiostrotrium metabolism*, William P. Norris, *chairman*: Cyril L. Comar, "Comparison of the biological behavior of calcium and strontium." Hermann Lisco, *chairman*: Janet Vaughan, "Radiation effects on bone."

18 July. *Effect of hormones on the*

skeleton, Ann Budy, *chairman*: Marshall R. Urist, "The transport of calcium in the blood of the estrogenized fowl"; C. Willett Asling, "Changes in skeletal tissues induced by pituitary growth hormone"; Isaac Schour, "The effects of hormones on teeth." Edward C. Reifenshtein, Jr., *chairman*: Charles E. Dent, "Studies on metabolic bone disease."

19 July. *General topics*, Harold C. Hodge, *chairman*: selected short papers.

Chemistry at Interfaces

Charles G. Dodd, *chairman*

Stephen Brunauer, *vice chairman*

22 July. *Contributions of solid-state physics to surface chemistry*, Donald Graham, *chairman*: Thomas J. Gray, "The role of lattice defects in chemical reactions on solid surfaces"; Walter L. Brown, "The interaction of a semiconductor with its surface"; David Turnbull and Gert Ehrlich, "Effects of solid structure on surface behavior."

23 July. *Monolayers*, Herman E. Ries, Jr., *chairman*: Hans J. Trumit, "Critical review of monolayer research and recent developments"; B. Roger Ray, "Denaturation of protein monolayers at the air-water interface; spreading and radiation effects"; Frederick M. Fowkes, "Monolayers at the oil-water interface"; Herman E. Ries, Jr., "The structure and collapse of monolayers at the air-water interface."

24 July. *Capillarity and fluid flow in porous media*, Irving Fatt, *chairman*: E. A. Flood, "The flow of fluids through activated carbon rods"; A. J. Gordon Allan, "Contact angles and wettability"; R. L. Chuoke, "Capillarity and viscous fluid flow"; P. C. Carman, "Molecular mobility in physically adsorbed films."

25 July. *Calorimetry in surface chemistry*, Norman Hackerman, *chairman*: K. J. Laidler, "Surface studies with the Calvet microcalorimeter"; W. Conway Pierce, "Heats of wetting of carbon blacks"; J. W. Whalen, "Heat of wetting measurements on petroleum reservoir rocks"; Norman Hackerman and A. C. Makrides, "Thermodynamic properties of quartz-water and quartz-hydrocarbon interfaces."

26 July. *Recapitulation and general discussion*.

Biochemistry and Agriculture

A. G. Norman, *chairman*

29 July. *Biochemistry of soil-plant relationships*, C. H. Wadleigh, *chairman*: D. P. Peters, "Water movement in plant roots"; C. E. Hagen, "Movement of inorganic nutrients into plant roots"; speaker to be announced, "Role of organic entities in the biochemistry of soil-plant relationships"; R. L. Starkey, "Role of microorganisms in the biochemistry of soil-plant relationships."

30 July. *Biochemistry of plant growth*

and growth control, F. C. Steward and A. G. Norman, *cochairmen*: R. B. Withrow, "Photocontrol of plant growth by red light"; A. R. Schrank, "Polarity implications in plant tropisms"; E. M. Shantz and F. C. Steward, "Naturally occurring substances inducing cell division in plants"; F. C. Steward and E. M. Shantz, "Relationships between chemical structure and activity in stimulation of cell division"; A. W. Naylor, "The significance of auxin destruction for the control of growth"; A. W. Galston, subject to be announced.

31 July. *Biosynthesis and postharvest changes*, P. K. Stumpf, *chairman*: David Hackett, "Energetics of respiration and its coupling to biosynthesis"; A. C. Neish, "Biosynthesis of cell-wall components"; R. U. Byerrum, "Biosynthesis of heterocyclic ring structures in higher plants"; P. K. Stumpf, "Enzymic synthesis and breakdown of long-chain fatty acids in higher plants"; H. K. Pratt, "Physiological approach to postharvest problems"; J. B. Biale, "Biochemical approach to postharvest problems."

1 Aug. *Biochemistry of action of bioicides*, G. L. McNew, *chairman*: J. L. Mullins, "Contrasts between physical and chemical modes of action of insecticides and herbicides"; L. P. Miller, "Uptake of fungicides by spores and their effects on cell membranes"; Virgil H. Freed, "The metabolism of aryloxy acids and related herbicidal compounds in plants"; C. W. Kearns, "Biochemical explanations for the cause of resistance to newer insecticides."

2 Aug. *Biochemistry of action of bioicides*, G. L. McNew, *chairman*: V. K. Rowe, "Toxicological aspects associated with the development of agricultural chemicals"; Roger G. Young, "The biochemistry of insecticide activity"; John E. Casida, "Effect of organic phosphates on metabolic processes of insects and plants."

Ion Exchange

W. J. Sloan, *chairman*

K. S. Spiegler, *vice chairman*

5 Aug. G. J. Crits, "Making good ion-exchange tests"; D. W. Breck, "Ion exchange in crystalline zeolites"; J-P. Cornaz, "Kinetic approaches"; J. A. Patterson, "Resin porosity—exchange rates."

6 Aug. L. Lapidus, "Packed bed studies"; C. W. Hancher, "Comparison of fixed and moving beds"; J. E. Salmon, "Ion exchange in the study of some inorganic complexes formed in solution"; J. H. B. George, "Electrolytic regeneration."

7 Aug. *Liquid ion-exchange media*: A. F. Preuss, "Anion exchange"; C. A. Blake, "Cation exchange"; A. C. Reents, "Unusual ion-exchange applications"; P. C. Carman, "Desalting water by ionic membrane cells—South Africa."

8 Aug. W. Rieman, III, "Chromato-

graphic separation of organic compounds with salt eluants"; F. Bruder, "Decolorizing resins"; Th. Bersin, "Properties of bioexchangers"; O. F. Garrett, "Applications of ion-exchange principles to the processing of milk."

9 Aug. J. A. Patterson, "Exchange based on energy-level difference."

Toxicology and Safety Evaluations

Norton Nelson, *chairman*

John A. Zapp, *vice chairman*

12 Aug. *Interpretation of chronic toxicity studies*, Robert Eckhardt, *chairman*: Arnold Lehman, "The relation between the duration of toxicity studies and the information yielded"; James R. M. Innes, "Clinically silent and incidental lesions in animals commonly used for experiment." *The hazards of radioactive fallout*, Merrill Eisenbud, *chairman*: John Bugher, "The public health implications of strontium-90 in radioactive fallout."

13 Aug. *Physiological and functional measures of toxicity*, John A. Zapp, *chairman*: Mary Amdur, "Toxic effects in relation to respiratory function"; Edward P. Radford, "Toxic effects in relation to renal and cardiovascular function." *Toxicity and enzymes*, Harold Hodge, *chairman*: Sir R. A. Peters, subject to be announced.

14 Aug. *A practical approach to dietary carcinogens*, W. H. Maguigan, *chairman*: W. C. Hueper, subject to be announced. *Dietary carcinogens*, C. Boyd Shaffer, *chairman*: James A. and Elizabeth C. Miller, "Mechanisms in dietary carcinogenesis."

15 Aug. *Potential as a factor in toxicological assessments*, Dorothy B. Hood, *chairman*: Karl Beyer, "Pharmacological interactions"; Kenneth P. Dubois, "Potentiation of the toxicity of cholinergic organic phosphates." *Sources of toxicological information*, Seymour D. Silver, *chairman*: Harry W. Hays, "NRC Toxicological Information Center"; Edward Press, "Poison-control centers."

16 Aug. Bernard L. Oser, *chairman*: Philip L. Harris, "Reproduction and lactation defects attributable to malnutrition"; Oscar Bodansky, "Effects of cytotoxic agents on blood levels of some tissue enzymes."

Organic Coatings

E. G. Bobalek, *chairman*

E. R. Mueller, *cochairman*

19 Aug. C. W. Gary, "Resin forming reactions of new diepoxides"; D. F. Koenecke, "Some applications of reflectance infrared methods in coatings research."

20 Aug. N. M. Wiederhorn, "Special aspects of the chemistry of soluble nylons"; W. W. Reynolds, "Solubility factors which influence the properties of alkyd solutions."

21 Aug. A. H. Loranger, "Syntheses

and evaluation of uniform particle size latexes"; J. F. Vitkuske, "Recent developments in the mechanism of emulsion polymerization"; G. L. Brown, "Formulation of films from polymer dispersions."

22 Aug. R. J. Wirshing, "A new approach to the study of the degradation of organic films"; F. L. Browne, "Swelling of paint films in water."

23 Aug. L. R. Brantley, "Morphology and rheology of organic coatings from adherometer hession measurements."

Glass

T. H. Davies, *chairman*

Rate Processes in Glass

26 Aug. *General introduction*: G. J. Dienes, "Rate studies in solids." *Mass transport*: R. Lindner, "Tracer studies of diffusion in crystalline and glassy oxides and silicates"; F. J. Norton, "Helium permeation through glass"; K. B. McAfee, "Stress-enhanced diffusion of gases through glass"; J. M. Lambert, "Complications in ionic diffusion arising from surface or near surface conditions"; S. D. Stookey and R. D. Maurer, "Kinetics of nucleation and crystal growth in glass."

27 Aug. *Viscous flow*: A. B. Bestul, "Structural interpretations of viscosity data"; J. O. Bockris, "Flow properties and structure of liquid silica"; subjects and speakers to be announced.

28 Aug. *Dielectric and mechanical relaxation*: M. Goldstein, "The relaxation of oriented chains in phosphate glasses"; speakers and subjects to be announced.

29 Aug. *Annealing of structural defects induced in glass*: H. Szymanski, W. Primak, D. Keifer, "Kinetics of annealing of radiation damage in vitreous silica"; Paul Levy, "Kinetics of radiation induced coloration in glass."

30 Aug. Summary discussion of conference; overflow papers; business meeting.

W. GEORGE PARKS

Department of Chemistry, University of Rhode Island, Kingston

AAAS Laurentian Hormone Conference

The 1957 Laurentian Hormone Conference of the AAAS will be held at Mont Tremblant Lodge, Mont Tremblant, Quebec, during the period 1-6 Sept. Investigators interested in attending this conference should make application to the Committee on Arrangements of the Laurentian Hormone Conference, 222 Maple Ave., Shrewsbury, Mass., at an early date and in any event no later than 10 May.

A conference rate of \$12 per person per day is extended to all invited participants. Attendance is limited to invitations issued by the Committee on Ar-

rangements. The following program has been arranged.

Hormone Structure and Function: "The chemistry and biological activities of 16-hydroxylated steroids," Seymour Bernstein, Lederle Laboratories, 1 Sept. (evening); "Structure and hormonal activity of some new steroids," Victor Drill and Byron Riegel, G. D. Searle and Company, 2 Sept.; "Relation of molecular structure of phenanthrene derivatives to growth," Charles Huggins and Elwood V. Jensen, University of Chicago, 2 Sept.; "Studies on the mechanism of action of estrogen," Gerald C. Mueller, University of Wisconsin, 2 Sept.

Hormones in Growth and Development: "Hormones and protein metabolism," J. A. Leatham, Rutgers University, 3 Sept.; "Effects of hormones on growth in fattening and meat production potential of livestock (of domestic animals)," F. X. Gassner, E. C. Reifenschein, Jr., John W. Algeo, and W. E., Mattox, Colorado Agricultural Mechanical College, 3 Sept.; "The hormonal control of mammary growth and lactation," William Lyons, University of Southern California, 3 Sept.

Aspects of Reproduction: "Cytological tests of chromosomal sex in relation to sexual abnormalities in man," M. L. Barr and Melvin Grumbach, University of Western Ontario and Columbia University, 4 Sept.; "Clinical aspects of sexual abnormalities in man," Robert Greenblatt, University of Georgia, 4 Sept.

Hormones and Metabolism: "Effects of hormones on human serum lipoproteins," Howard Eder, Albert Einstein College of Medicine, 5 Sept.; "Effect of hormones on connective tissue metabolism," Albert Dorfman and Sara Schiller, University of Chicago, 5 Sept.; "Hormonal influences on connective tissue changes in aging," Harry Sobel and Jessie Marmorston, Cedars of Lebanon Hospital, 5 Sept.

Neurohumors: "Distribution and metabolism of adrenergic neurohumors in axones and tissues," U. S. von Euler, Stockholm, Sweden, 6 Sept.; "The excretion of epinephrine and norepinephrine under stress," Fred Elmadjian, Justin M. Hope, Edwin T. Lamson, Worcester Foundation for Experimental Biology, 6 Sept.

Sanitary Engineering

The tenth Municipal and Sanitary Engineering Conference will be held on the campus of the University of Florida, 19-20 Mar. The meeting is to be centered around the theme "The impact of industrial expansion on man and his environment."

A program has been arranged for the benefit of sanitary engineers, local gov-

ernment and public health officials, industrial representatives, and legislators. Some of the subjects on which papers will be presented include factors in plant location, water resources, liquid waste disposal, health problems, industrial hygiene, air pollution, and industrial application of nuclear energy.

All who are interested are invited to attend. A registration fee of \$8 includes a ticket to the banquet and a copy of the conference proceedings when published. Further information may be obtained from the conference chairman, Dr. E. R. Hendrickson, College of Engineering, University of Florida, Gainesville, Fla.

N.Y.U.-Bellevue Convocation

The New York University-Bellevue Medical Center Convocation in commemoration of the Diamond Jubilee of University Hospital will be held 4-5 Mar. and will have as its theme, "The hope of mankind—health and peace." Prominent scientists and statesmen have been invited to participate in the 2-day program, which has been planned to honor one of the first hospitals in the country to specialize in postgraduate instruction and training of physicians. The convocation panels will be concerned with medicine and the role it serves in man's struggle for a better and happier way of life.

University Hospital had its origin in 1882 when it was organized as the New York Post-Graduate Medical School and Hospital as the result of the efforts of a group of New York physicians who realized that a lag existed between general medical practice and the latest developments in medicine and surgery. A number of these physicians had been associated with the medical faculty of New York University but left because they wished to devote all their efforts to the continuing training of practicing physicians.

In December 1948, New York Post-Graduate Medical School and Hospital merged with the newly formed New York University-Bellevue Medical Center and thereby became known as NYU Post-Graduate Medical School and University Hospital. Today, more than 1000 physicians are on the hospital staff. In the past year approximately 38,000 patients made 142,000 clinic visits; 10,000 inpatients received 110,000 days of care; 18,000 regular x-rays were examined; 8000 anesthetics given; 14,000 microbiological specimens were examined; there were 7000 pathological examinations and 1200 cases carried by the Social Service Department.

The proposed union of the Post-Graduate Medical School and Hospital was made possible by Rush H. Kress, then vice president of the Samuel H. Kress

Foundation and a member of NYU-Bellevue Medical Center board. The foundation contributed more than \$8 million to the development of the medical center and has given continuing support to postgraduate training.

The hospital is a part of a multi-million-dollar medical center development program. To date, three buildings are completed and in full operation: the Institute of Physical Medicine and Rehabilitation; the Henry W. and Albert A. Berg Institute for Experimental Physiology, Surgery and Pathology; and the Medical Science Building. The students' Hall of Residence was placed in operation this month and Alumni Hall and lecture rooms will be opened in September 1957. The new 20-story hospital to replace the present University Hospital, will complete the medical center development program.

Forthcoming Events

April

1-2. Industrial Engineering Conf., West Lafayette, Ind. (K. E. Glancy, Div. of Adult Education, Purdue Univ., West Lafayette.)

1-4. American Assoc. of Petroleum Geologists, 42nd annual, St. Louis, Mo. (R. H. Dott, AAPG, Box 979, Tulsa, Okla.)

1-4. International Anesthesia Research Soc., cong., Phoenix, Ariz. (A. W. Friend, Wade Park Manor, Cleveland 6, Ohio.)

1-4. Society of Economic Paleontologists and Mineralogists, annual, St. Louis, Mo. (C. P. Ellison, Jr., Dept. of Geology, Univ. of Texas, Austin.)

1-5. Assoc. of American Geographers, annual, Cincinnati, Ohio. (B. W. Adkinson, Reference Dept., Library of Congress, Washington 25.)

2-3. Future Developments in Food Preservation, symp., Kansas City, Mo. (Food Symposium, Midwest Research Inst., 425 Volker Blvd., Kansas City 10.)

4-5. Dietary Fats—Helpful or Harmful, 3rd annual nutrition conf., Detroit, Mich. (A. H. Smith, Wayne State Univ. College of Medicine, Detroit 7.)

4-6. American Mathematical Soc., New York, N.Y. (J. H. Curtiss, AMS, 190 Hope St., Providence 6, R.I.)

4-6. American Rocket Soc., spring, Washington, D.C. (A. G. Haley, 1735 De Sales St., NW, Washington 6.)

7-10. Pan American Assoc. of Ophthalmology, 4th interim cong., New York, N.Y. (B. F. Payne, 17 E. 72 St., New York 21.)

7-12. American Chemical Soc., Miami, Fla. (A. H. Emery, ACS, 1155 16 St., NW, Washington 6.)

8. Phi Lambda Upsilon, Miami, Fla. (T. B. Cameron, Dept. of Chemistry, Univ. of Cincinnati, Cincinnati 21, Ohio.)

8-10. American Soc. of Mechanical Engineers, spring, Birmingham, Ala. (C. E. Davies, ASME, 29 W. 39 St., New York 18.)

8-12. Food Bacteriology, internat. symp., Cambridge, England. (Dr. Mossel,

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8-12. Surface Activity, 2nd world cong.,
London, England. (Congress Secy., 14
Belgrave Sq., London, S.W. 1.)

9-10. Industrial Electronics Education
Conf., annual, Chicago, Ill. (E. A. Roberts,
Armour Research Foundation, Illinois
Inst. of Technology, Chicago 16.)

10-12. Nuclear Instrumentation Conf.,
natl., Atlanta, Ga. (H. Kindler, Instru-
ment Soc. of America, 313 Sixth Ave.,
Pittsburgh, Pa.)

10-13. Conference on Embryology and
Experimental Morphology, Cambridge,
England. (D. R. Newth, Dept. of Zoology,
University College London, Gower St.,
London W.C. 1.)

11-13. American Assoc. of Pathologists
and Bacteriologists, annual, Washington
D.C. (E. A. Gall, Cincinnati General
Hospital, Cincinnati 29, Ohio.)

11-13. Southwestern Inst. of Radio En-
gineers Conf. and Electronics Show, 9th
annual, with 2nd National Simulation
Conf., Houston, Tex. (F. C. Smith, Jr.,
Box 13058, Houston 19.)

12-13. Colorado-Wyoming Acad. of
Science, annual, Fort Collins, Colo. (O.
W. Olsen, Colorado A.&M. College, Fort
Collins.)

12-13. Eastern Psychological Assoc.,
annual, New York, N.Y. (G. G. Lane,
Dept. of Psychology, Univ. of Delaware,
Newark.)

12-13. New Orleans Acad. of Sciences,
New Orleans, La. (A. Welden, Dept. of
Biology, Newcomb College, New Orleans.)

12-14. American Assoc. for Cancer Re-
search, Chicago, Ill. (H. J. Creech, Inst.
for Cancer Research, Fox Chase, Phila-
delphia 11, Pa.)

12-14. American Assoc. of Physical
Anthropologists, annual, Ann Arbor,
Mich. (J. H. Spuhler, Dept. of Human
Genetics, Univ. of Michigan Medical
School, Ann Arbor.)

12-14. American Soc. of Human Ge-
netics, annual, Ann Arbor, Mich. (E. J.
Gardner, Dept. of Zoology, Utah State
College, Logan.)

12-14. National Speleological Soc.,
Natural Bridge, Va. (Mrs. M. McKenzie,
1407 Hickory Ct., Broyhill Park, Falls
Church, Va.)

13. Society for the Scientific Study of
Religion, spring, New York, N.Y. (W. C.
Clark, Hartford School of Religious Edu-
cation, Hartford 5, Conn.)

13. South Carolina Academy of Science,
annual, Columbia (Miss M. Hess, Box 114,
Winthrop College, Rock Hill, S.C.)

14-16. Telemetering Symposium, natl.,
Philadelphia, Pa. (A. S. Westneat, Jr.,
Applied Science Corp., Box 44, Prince-
ton, N.J.)

14-20. American Physiological Soc.,
Chicago, Ill. (M. O. Lee, APS, 9650 Wis-
consin Ave., NW, Washington 14.)

15-17. American Soc. of Lubrication
Engineers, annual, Detroit, Mich. (W. P.
Youngclaus, Jr., ASLE, 84 E. Randolph
St., Chicago 1, Ill.)

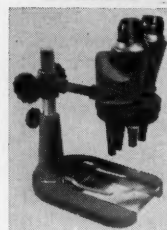
15-17. Molecular Mechanism of Rate
Processes in Solids, Faraday Soc. discus-
sion, Amsterdam, Netherlands. (Faraday
Soc., 6 Gray's Inn Sq., London, W.C.1.)

(See issue of 15 February for comprehensive list)

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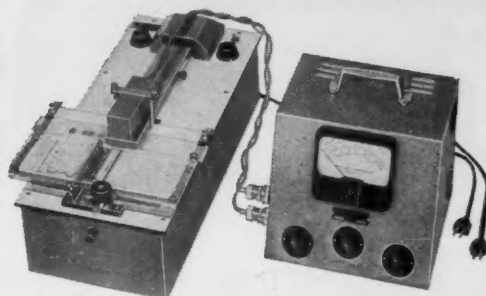
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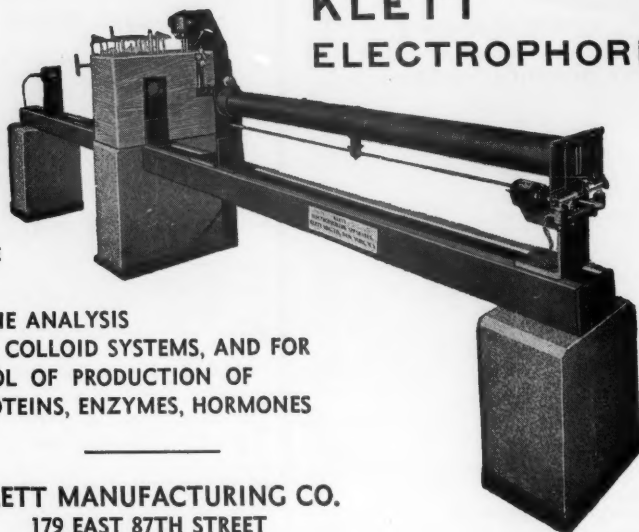
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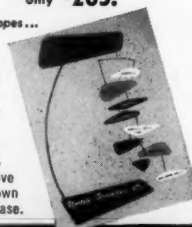
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EQUIPMENT NEWS

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■ FLEXIBLE FERROMAGNETIC PLASTIC, trademarked "Ferrotron," is available in rod and tape form. Rod diameters are $\frac{1}{8}$, $\frac{3}{32}$, and $\frac{1}{4}$ in. Tape is $\frac{1}{2}$ in. wide and is stocked in thicknesses of 4, 8, 16 and 32 mil. The material is said to combine flexibility with good dielectric strength, constant magnetic permeability to about 3000 Mcy/sec, and moisture and temperature resistance. (Polymer Corporation of Pennsylvania, Dept. S168)

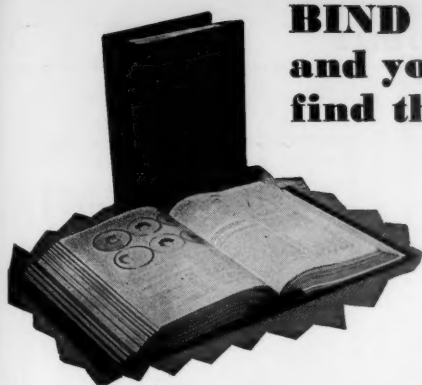
■ MICROCARD READER model 6B, operating on 110- to 120-v, 60-cy/sec current, is said to offer exceptional brilliance for reading microopaque cards. Also available is a pocket-size reader that will operate from self contained batteries or 110-v current. (Microcard Corporation, Dept. S194)

■ EXTERNAL-INTERNAL DEFIBRILLATOR provides an output of 980 v. Shock durations of 0.1, 0.2, 0.5 sec are automatically timed. No warm-up period is required. Safety features are provided. (Levinthal Electronic Products, Inc., Dept. S174)

■ PHASE METER measures phase angles between two alternating voltages in frequency ranges from 1 cy to 20 kcy/sec (model 405L) and from 8 cy to 500 kcy/sec (model 405H). Relative accuracy is $\pm \frac{1}{4}$ deg, and absolute accuracy is ± 1 deg or 2 percent at any range. Input impedance is 3 Mohm shunted with 20 μ f for the 405H and 6.8 Mohm shunted with 20 μ f for the 405L. (Advance Electronics Laboratories, Inc., Dept. S171)

■ PRINTER-PLOTTER uses electrographic principles to achieve a printing speed of 5000 characters serially. Characters are impressed as a pattern of electrostatic charges on paper by passing short bursts of current through selected wires in a matrix. The pattern picks up ink particles from a dry-ink bath. The ink is fixed by passing the paper over a hot roll. Each character is formed in 3 μ sec. (Burroughs Corp., Dept. S180)

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National Bureau of Standards



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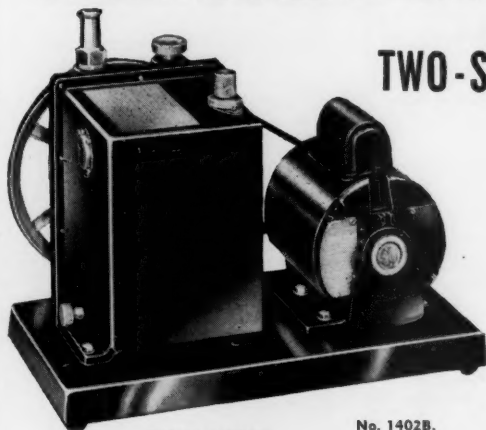
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Literature Searcher or Librarian. Doctorate, biological and agricultural sciences; masters, library science; experienced head biological sciences library. Box 61, SCIENCE. 3/1

Microbial Genetics, Virology; Ph.D., 9 years' college teaching and research. Desires stimulating academic position. Box 78, SCIENCE. X

Microbiologist, Ph.D. Virology, tissue culture, biometry, chemotherapy, publications, industrial experience. Box 68, SCIENCE. X

Microbiologist, Ph.D. 4 years' experience including biochemistry and infectious diseases. Publications. Desires teaching or research position. Box 77, SCIENCE. X

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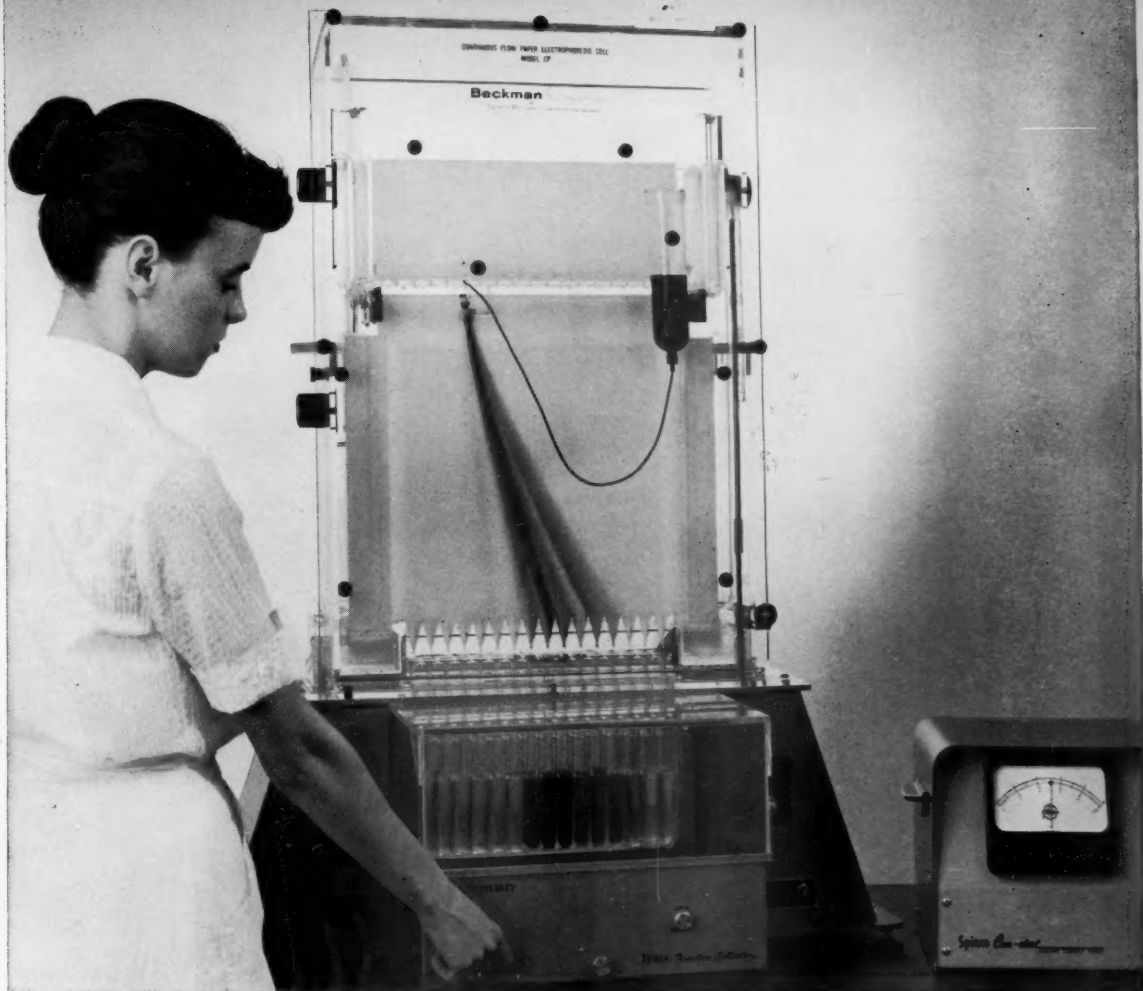
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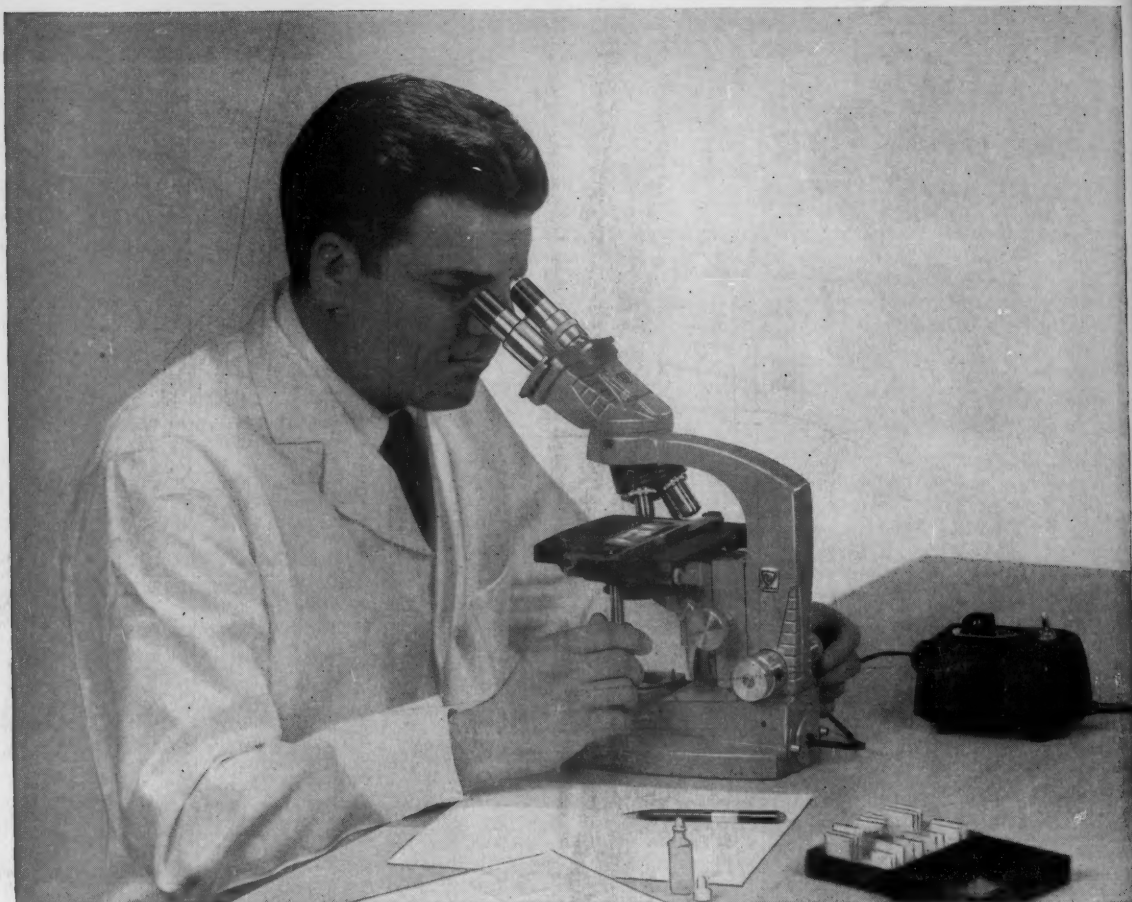
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